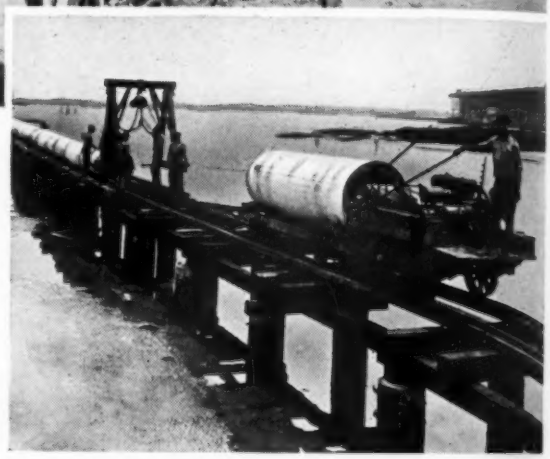
WATER & SEWAGE WORKS

LIQUID CHLORINE LINE AND EXPANSION LOOP—LOUISVILLE, KY.

LOCK JOINT REPEAT PERFORMANCES

1943 – Installing 36" pipe alongside of old wood stave pipeline which it replaces.

1921 – Installation of Lock Joint pressure pipeline on Trestle over Elizabeth River.



10 JOBS SINCE 1920

AS NORFOLK GROWS so must its water supply system. For more than 25 years municipal engineers have met this City's continually increasing need for water by installing 73 miles of Lock Joint Reinforced Concrete Pressure Pipe. Thus a water supply system of sustained high carrying capacity, negligible maintenance cost, immense structural strength and unfailing service is assured for generations.

Repeat orders from Norfolk and many other American cities are convincing evidence of the complete dependability, high quality and economy of Lock Joint Reinforced Concrete Pressure Pipe.

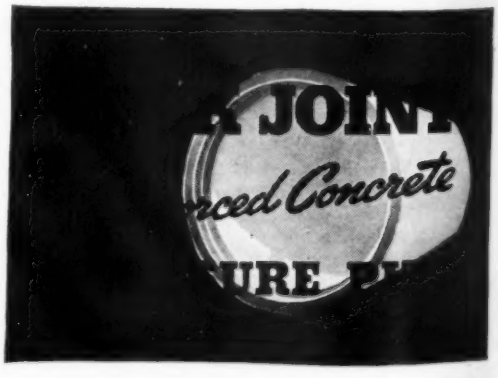
For future projects, large or small, specify Lock Joint Pipe.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

★

SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.



LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

Pressure Pipe Plant – Wharton, N. J. **Sewer Plant – Kenilworth, N. J.**

BRANCH OFFICES: Denver, Colo. • Chicago, Ill. • Kansas City, Mo. Rock Island, Ill. • Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio Hartford, Conn. • Navarre, Ohio

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off., March, 1948. Volume 95. Number 3. Published monthly by Gillette Publishing Co. at 404 North Wesley Ave., Mount Morris, Ill. Per copy, 25c. Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Application made for transfer of second-class entry from the post office at Chicago, Illinois, to the post office at Mount Morris, Illinois. Executive and Business offices, 22 W. Maple St., Chicago 10, Illinois. Editorial office, 155 E. 44th St., New York 17, N. Y.

Precision Engineered for Long, Hard Service

15 Years of Service . . . Over 1700 Installations

THE COMMINUTOR

Is Specifically Designed to Screen and Cut Sewage Solids Under Water

From the Mediterranean to the Philippines; from the Arctic Circle to Australia, wherever there is modern sewage treatment, you will find Comminutors. Such world-wide acceptance is based on a machine that efficiently and effectively performs a service unmatched by any other type of equipment.

The Comminutor, compact, economical, silent, does away with the need for screens, rakes, grinders, burial pits and incinerators or other means of destroying the filth that is obtained by the old methods. With no screenings to stand in the open, there is no odor, no additional labor, and none of the unsightliness usually connected with screenings and their disposal.

The sturdy construction of the Comminutor is the result of long experience. The drum is a single casting, precision machined to close tolerances. Cutting bars, combs and teeth are firmly seated, yet easily removable for sharpening or replacement. They are staggered and distributed to effect multiple small shearing actions. This, plus inertia of the drum in motion, and gearing, allows use of small motors with consequent power economy. No housing is required for the Comminutor.

The Chicago Pump Company Comminutor is the result of many years of research and trial. "Bugs" in early models have long been eliminated so that the machines in use for many years have established an incomparable record of successful performance in the field.

If you have work in the sewage treatment field, write today for the Comminutor Bulletin which gives complete engineering data.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

• COMMINUTORS • SWING DIFFUSERS •
• FLUSH-KLEENS • 'PAKAGE' PLANTS •
SCRU-PELLERS • SAMPLERS • NON-CLOG PUMPS

2349 WOLFRAM ST. CHICAGO 18, ILLINOIS

Shreveport's 2,000,000 Gal. Horton Tank

performs two functions

1. **Reinforces the weak parts of the Shreveport, La., distribution system which are located in areas of high elevation.**
2. **Helps equalize pressure over the entire distribution system.**

The tank is filled during lean consumption periods at night and reinforces the supply from the pumping plants during heavy consumption periods. It floats on the system, equalizing the pressure and relieving the system of shocks brought about by direct pressure pumping. A recent report shows that a minimum pressure of 50 lbs. per sq. in. is maintained at the highest elevation in the system.

The locations of the two pumping stations and the new elevated tank form a triangle and feed the system from three different directions—a fundamental but important feature of good municipal water system design.

ENGINEERING DATA

Tank Capacity	2,000,000 gallons
Height to Bottom	101 feet
Tank Diameter	102 feet
Tank Design	radial cone bottom supported by sixteen 54-in. diam. cylindrical columns and a 10-foot diam. riser.

CHICAGO BRIDGE & IRON COMPANY

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Plants in Birmingham, Chicago and Greenville, Pa.

In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

WATER & SEWAGE WORKS

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

COMING!

Considering Radio Communication?

If so an article to appear in our annual Reference & Data Number will prove of interest and value to you. Written at our request by a water works manager of considerable experience with radio in utility operation, this article tells of the proper procedure from the ground up in securing wave band allocation, selecting the most practical and economical equipment, and its proper installation and operation. The author is—

WM. C. MORSE, Supt.,
Seattle Water Dep't., Seattle, Wash.

Use of Reynolds Number—Fact or Fancy?

Is an illuminating article on pipe flow formulas, their genealogy, development, and application. Neither the title nor the formulas contained in the article should scare off anyone having problems dealing with pipe flows, because the article has some highly practical results and conclusions by its author—

CHARLES H. CAPEN, Chief Engr.
No. Jersey Water Sup. Comm.

Pipe Line Capacity— Its Preservation or Restoration

Constitutes a brief review of the causes of loss of delivery capacity of pipe lines with increasing age, and the high cost of such depreciation. Then follows a description of known and tested remedial measures for the correction or elimination of such losses, including measures for the restoration of capacity of existing pipe lines, reduction in pumping costs, etc. Contributed but a short time before his recent passing, the author is the late—

WM. S. LEA, Consulting Engineer,
Montreal, Canada

Sizing Sanitary Sewers

In an article which presents a novel method of designing (sizing) sanitary sewer systems with the aid of graphic diagrams developed by—

JOHN G. MONTGOMERY, Sanitary Engr.
Veterans' Administration, Washington, D. C.

Utilization of Chlorine During Septicization of Sewage

Is a report on studies made of sewage chlorination and the economics of the process as affected by septicization, all of which has a pertinent bearing on methods of chlorination to employ in order to obtain maximum effectiveness and the greatest chlorine economy. The author is—

H. HEUKELEKIAN,
Rutgers Univ., New Brunswick, N. J.

Operation and Maintenance of Pneumatic Storage Tanks

There has developed a decided interest in underground pneumatic water storage tanks for improving service to the fringe areas of the water supply system where some form of pressure storage or booster pumping is the economical remedy. As a guide to the users of pneumatic storage facilities, we have arranged to publish an article dealing with the proper and economical installations, operation and maintenance of this form of distribution storage by an engineer well qualified to develop such an article—

J. B. WILKINSON, Chief Engr.,
Fire Ins. Rating Bureau, Milwaukee, Wis.

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THE SAGA OF 50 MILLION

In the 128 years since 1817, 25 cities had laid 50 million feet of cast iron water mains in sizes 6-inch and up. What had happened to those mains and to other facilities? A committee representing three water works organizations determined to find out. For these 25 cities, large and small, stretching from Canada to Florida, provided a representative cross-section of water service conditions generally. Facts developed could therefore be accepted as valid by all water works men. The survey was recently completed and the findings published by the American Water Works Association.

What happened to the 50 million feet of cast iron pipe? The saga is told by the chart. It shows that, of all the cast iron water mains ever laid in the 25 cities since 1817, in sizes 6-inch and up, *96% are still in service.* This statement is based on facts secured *by* pipe users, *from* users, *for* users!

The cast iron pressure pipe industry, in spite of raw material shortages, achieved in 1947 one of the biggest production years in footage in the history of the industry, and has recently installed additional footage capacity.

Mr. Q-Check says *Philadelphia laid its first 8-inch pipe in 1822 and 99.2% of all pipe of this size laid during the past 125 years are still in service.*

All statements and percentages regarding service records of cast iron mains set forth in this advertisement are based on published reports of a survey directed by a Joint Committee representing the American Water Works Association, New England Water Works Association, and the Institute of Water Supply Utilities. The findings, as they apply to cast iron pipe, have been reprinted by permission in our brochure "Survival and Retirement Experience with Cast Iron Water Mains." If you have not received a copy, write to Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, 122 South Michigan Avenue, Chicago 3, Illinois.

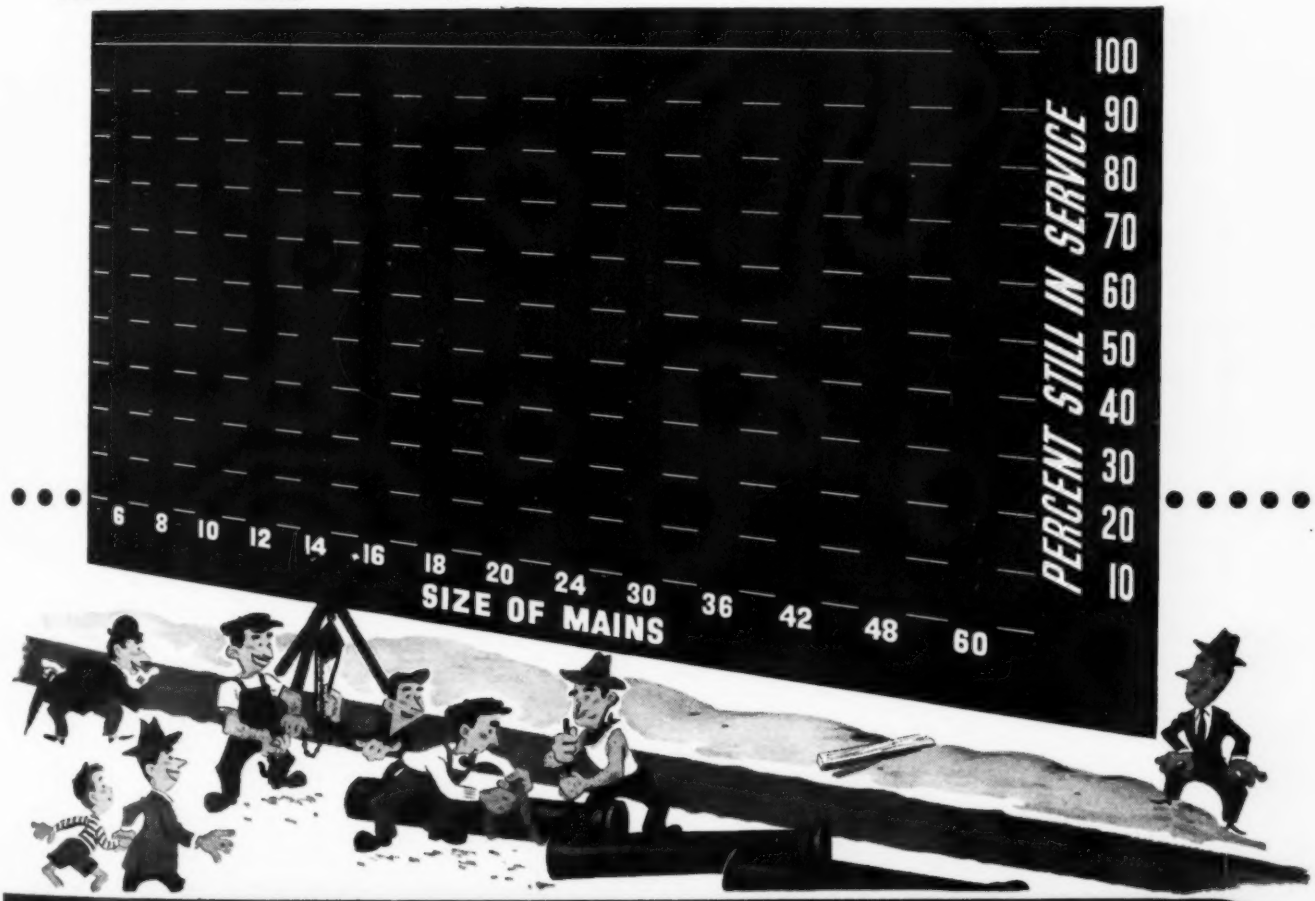
CAST IRON PIPE

FEET OF CAST IRON PIPE

96% OF ALL CAST IRON WATER MAINS* LAID IN THESE 25 CITIES OVER A PERIOD OF 128 YEARS ARE STILL IN SERVICE.

Alexandria, Virginia
Babylon, New York
Clinton, Iowa
Clyde, New York
Denver, Colorado
Des Moines, Iowa
Detroit, Michigan
Huntington, West Virginia
Jamaica, New York
Merrick, New York
Norwich, New York
Ottawa, Ontario
Philadelphia, Pennsylvania
Portland, Maine
Rochester (Suburban), N. Y.
St. Mary's, Pennsylvania
St. Paul, Minnesota
Sag Harbor, New York
Scranton, Pennsylvania
Springfield, Massachusetts
Summit, New Jersey
Syracuse (Suburban), N. Y.
Utica, New York
West Palm Beach, Florida
Winnipeg, Manitoba

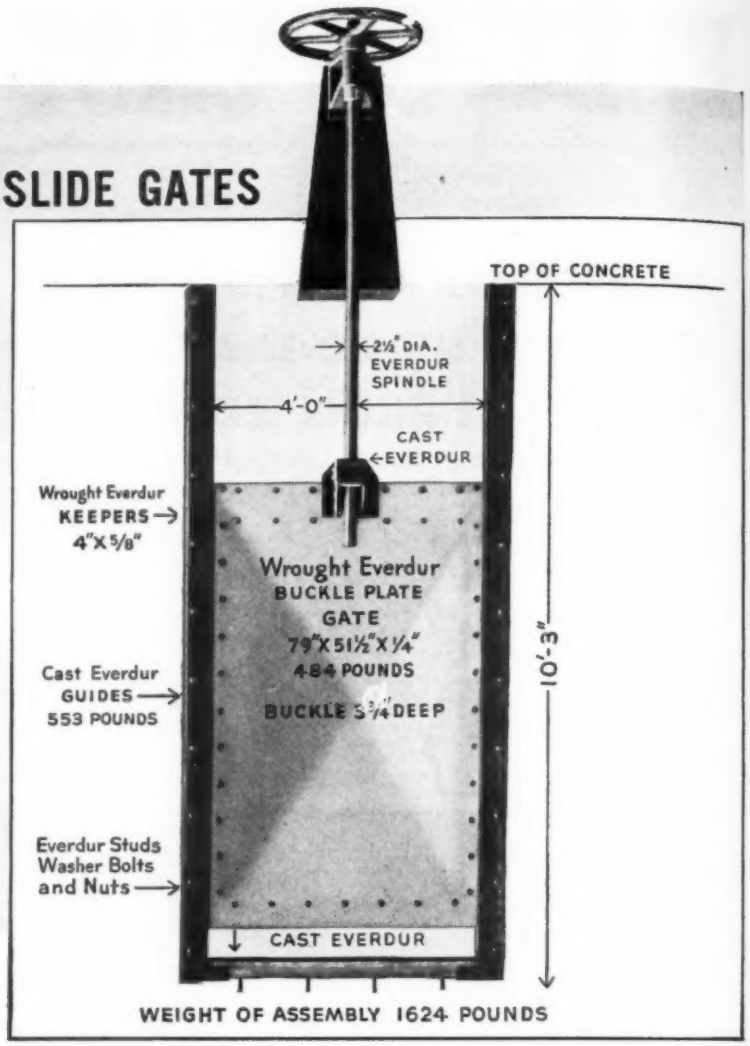
*Sizes from 6 to 60 inches.



SERVES FOR CENTURIES

FROM COTTER PINS TO SLIDE GATES

Everdur STANDS UP LONGER IN SEWAGE SERVICE



One of the five 13-year-old shut-off gates of Everdur Metal in the screen room of the Rahway Valley Joint Meeting Sewage Treatment Plant.

FOR 20 years Everdur* Copper-Silicon Alloys have performed well under the corrosive conditions imposed on sewage treatment equipment. These alloys have unusual resistance to corrosion. In addition, they provide high strength and, according to type, may be cast, hot or cold rolled, drawn, spun, forged or welded.

A good example of Everdur advantages is seen in the five shut-off gates in the screen room at Rahway, N. J., installed more than 13 years ago. These gates, which operate smoothly and easily by hand, weigh 1624 lbs., while cast, electrically-driven gates for the same service would have weighed well over four tons each!

In view of the fact that sewage service must not fail, a cotter pin may be as essential as the most massive equipment. Thus, Everdur Metal has been more and more widely specified for such uses as:

Coarse and Fine Screens
Swing Gates
Built-up Sluice Gates
Bar Rack Aprons
Effluent and Scum Weirs
Scum Baffle Brackets
Troughs
Screen Hoppers
Orifices
Backets
Anchors
Ladders
Float Gage Chains
Valve Springs
Manhole Steps
Guides
Walkways
Bars and Plates
Bolts and Nuts

For detailed information, write for Publications E-11 and E-5.

*Reg. U. S. Pat. Off.

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from mine to consumer
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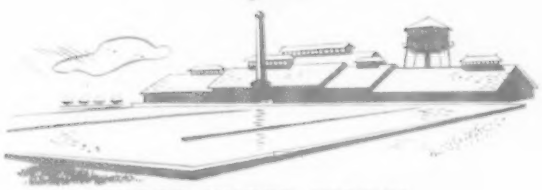
GENERAL CHEMICAL "ALUM"

...Equally Efficient for Coagulation of WATER and SEWAGE!



FOR WATER WORKS

1. Produces crystal clear water.
2. Gives better floc formation.
3. Promotes better settling and longer filter runs.
4. Aids in reduction of tastes and odors.
5. Has no chlorine demand.
6. Is a *low cost* coagulant.
7. Superior in tests against other coagulants.
8. High in quality. Its constant uniformity can be depended upon.

FOR SEWAGE PLANTS

1. Clean, easy to handle.
2. Dry feeds well or dissolves readily for solution feeding.
3. Simple application. Requires only low cost feeding apparatus and minimum attention.
4. Clear, colorless effluents are possible.
5. Sludge digests readily.
6. Treated digested sludge dries quickly with minimum of odor.
7. Chlorine consumption is cut due to lower demand of clarified sewage.
8. Economical to use.

Aluminum Sulfate is almost universally accepted by water experts as the best coagulant for removal of turbidity, color and bacteria from water . . . and General Chemical Aluminum Sulfate is the outstanding choice the nation over. That's because its high quality and constant uniformity have given it a time-tested reputation for reliability among operating men in towns and cities all over America.

Municipal officials in charge of sewage treatment also find that clarity of sewage effluent is easily obtainable with General Chemical Aluminum Sulfate for the many reasons outlined above. For your water and sewage disposal systems, specify General Chemical "Alum"—*preferred by most American cities.*

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

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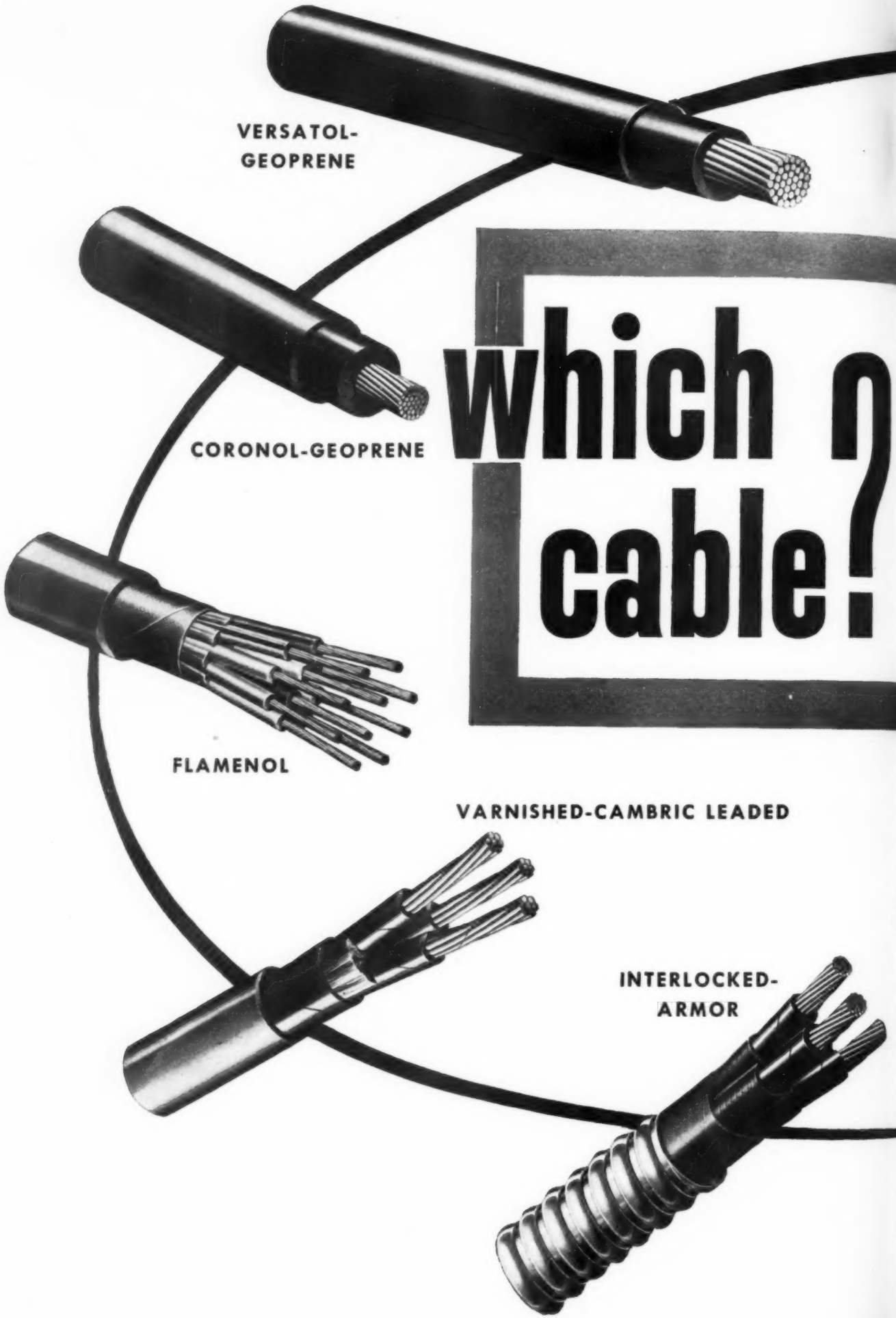
FOR AMERICAN INDUSTRY


VERSATOL-
GEOPRENE
CORONOL-GEOPRENE
FLAMENOL
VARNISHED-CAMBRIC LEADED
INTERLOCKED-
ARMOR

which cable?

check this table

Maximum Voltage	How Installed	Installation Condition	Recommended Cable Type
	POWER CIRCUITS		
600	Exposed	Dry	Interlocked-Armor
	Conduit or Duct	Wet or Dry	Versatol-Geoprene
	Direct Burial	Wet	Versatol-Geoprene
5000	Exposed	Dry	Interlocked-Armor
	Direct Burial	Wet	Coronol-Geoprene
	Conduit or Duct (without manholes)	Wet or Dry	Coronol-Geoprene
	Duct (with manholes)	Wet	Varnished-Cambric Leaded*
15000	Conduit or Duct	Wet or Dry	Varnished-Cambric Leaded*
	CONTROL CIRCUITS		
600	No restrictions		Flamenol
	YARD LIGHTING CIRCUITS		
600	Direct Burial	Wet	Versatol-Geoprene
5000	Direct Burial	Wet	Flamenol Series-Lighting

* A Geoprene jacket over the lead should be specified where there may be exposure to organic acids or alkalies.

CAREFUL CABLE SELECTION: KEY TO SYSTEM RELIABILITY

Poor cable or poor cable selection can make even the best electric equipment ineffective. High power loss, early deterioration, costly cable faults and damage to connected equipment can easily plague the sewage or waterworks plant where cable was "just thrown in."

But your G-E cable specialist can help you and your consultants avoid these troubles in your new plant. His responsibility is to select the right cable for each type of service . . . and he has the "job-fitted" cable to do it. Thousands of successful installations stand behind his choice.

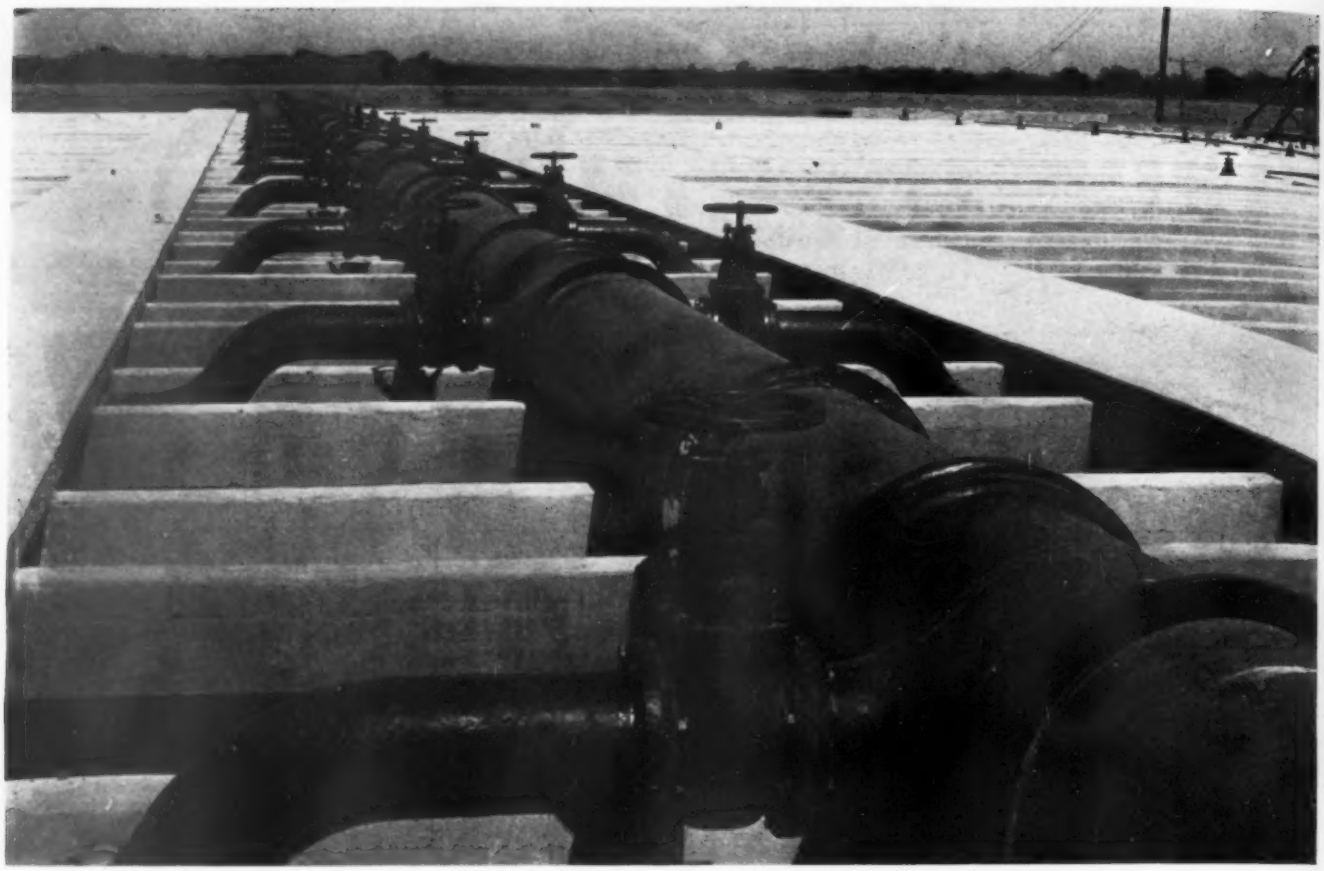
But cable is only one element of a co-ordinated electrical system for water and sewage plants. If you elect to purchase *all* the electric equipment for your new plant from General Electric, including Cabinetrol, motors and unit substation, we will assume the added responsibility for the co-ordination and supervision during installation of all this electric equipment—thus simplifying your engineering, buying, installation and servicing because you're dealing with only one manufacturer. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

CO-ORDINATED

WATER-PLANT . . . SEWAGE-PLANT

ELECTRIFICATION

GENERAL ELECTRIC



24" Mono-Cast Centrifugal Pipe, 24" x 8" Tees and 8" Offsets installed as main air line of sewage treatment works

MONO-CAST CENTRIFUGAL PIPE

Renders Quality Service

In Water Works and Sewage Treatment Plants

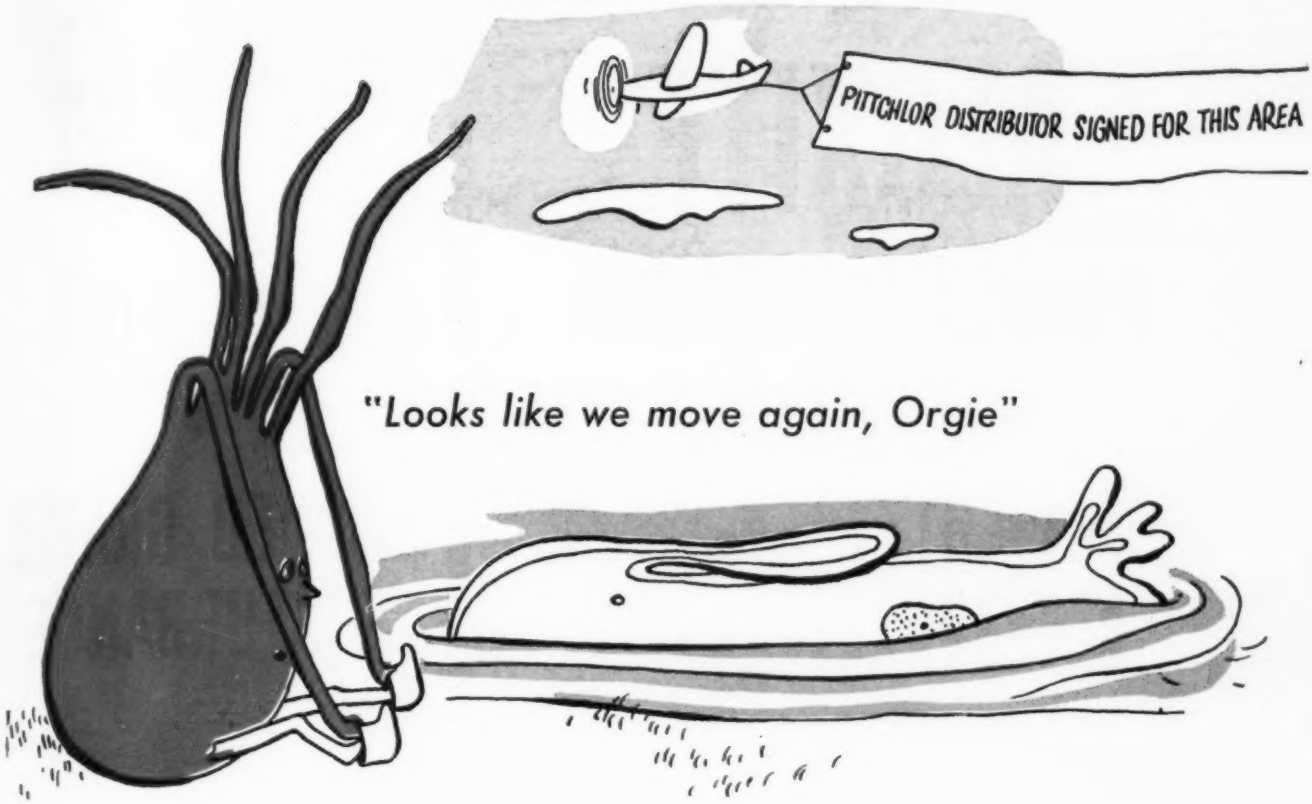
The feeling of confidence that exists between the Acipco organization and that great body of men responsible for the development of water and sewage works in these United States is the result of many years of close cooperation. Since the beginning of our Company, Acipco has constantly worked hand in hand with engineers, contractors and superintendents in solving piping problems in their respective fields.

As always during the past, Acipco offers quality pipe and fittings plus experienced personal service of similarly high caliber.

Refer your next piping problem to Acipco and utilize both our extensive manufacturing facilities and our nearly half a century of experience in furnishing pipe and fittings for water works and sewage disposal plants.

AMERICAN CAST IRON PIPE COMPANY

BIRMINGHAM 2, ALABAMA

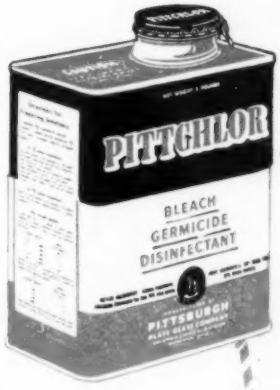


DISTRIBUTION OPPORTUNITIES AVAILABLE IN SOME AREAS FOR

*PITTCHLOR

A new Pittchlor distributor in any territory is bad news for chlorine-susceptible bacteria and algae. Because that means Pittchlor will soon be at work in the chlorination of water supplies, the treatment of sewage, and for many other disinfection, deodorization and general sanitation purposes. Pittchlor—a high-test, stable calcium hypochlorite—containing 70% available chlorine, is easy to use either manually or through relatively simple mechanical feeders.

Reg. U. S. Patent Office



Stocked by leading jobbers —in 5 lb. resealable cans (9 per case), 33¼ lb. cans (12 per case) and 130 lb. drums.

Investigate now.

PITTSBURGH PLATE GLASS COMPANY,
COLUMBIA CHEMICAL DIVISION, DEPT. A-21
FIFTH AVENUE AT BELLEFIELD, PITTSBURGH 13, PA.

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TITLE_____

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PITTSBURGH PLATE GLASS COMPANY

ALOXITE

POROUS UNDERDRAIN SYSTEM

Eliminates

- MUD BALLS
- DEAD SPOTS
- GRADED GRAVEL DISTURBANCE

HIGH HEAD LOSS
•
EXCESSIVE WASH WATER VOLUME
•
SHORT FILTER RUNS

HIGH MAINTENANCE COSTS
•
STRAINER CLOGGING

All troubles caused by graded gravel disappear on installing the ALOXITE aluminum oxide porous plate underdrain system in rapid sand filters.

Dispensing with graded gravel, displacement is no longer a problem. Mud balls are eliminated. Backwashing is uniform over the entire bed. Less wash water is required to maintain clean filter media. Longer filter runs are frequently obtained.

Added to these benefits is lower filtering and backwashing operating heads. They result from smaller pressure loss through the underdrain system and reduced filter heights.

More complete data are provided in Engineering Bulletin No. 2. For a copy, write Department M38, The Carborundum Company, Refractories Division, Perth Amboy, New Jersey.

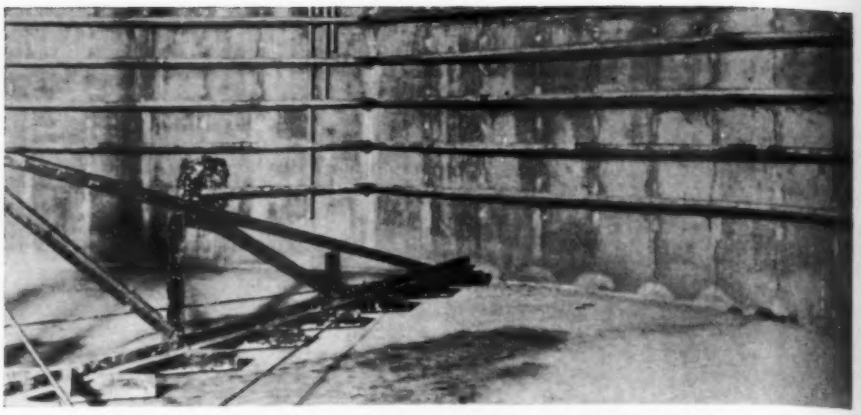
Underdrain Plates

BY CARBORUNDUM
TRADE MARK

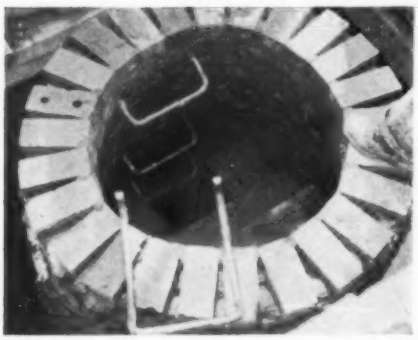
"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

IN { NEW CONSTRUCTION / PLANT EXTENSION / REPAIR WORK

curb excessive maintenance with BYERS WROUGHT IRON

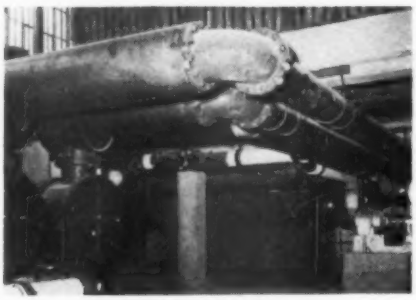


DIGESTER COILS AND STIRRING MECHANISM



MANHOLE LADDER STEPS

VENTILATING DUCTS



SLUDGE GAS LINES

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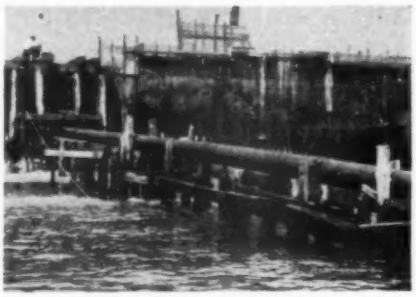


OUTFALL LINES

TRASH RACKS AND SCREENS

The leading question in the mind of every thoughtful man concerned with sewage treatment plant construction is the minimizing of future maintenance. The leading answer is Byers Wrought Iron.

The best indication of the superior service qualities of wrought iron is found in its almost universal use for the hottest spots in treatment plants. Digestion coils, for instance, represent one of the most punishing services of all. The naturally high corrosiveness of the sewage is increased by elevated temperatures. Where engineers have had a chance to observe and compare . . . you'll generally find wrought iron on the job.

Stirring mechanisms face the same conditions. In one western plant, the original mechanism, made of low-first-cost materials, lasted only a year. Then wrought iron was used . . . and at last report had been seven years on the job, with no sign of failure.

In Manhole ladder steps, the trend is definitely toward wrought iron; many municipalities have already standardized on the material. Engineers, bothered with frequent failures of steps made of other metals, remembered that when wrought iron was used there had been no difficulties . . . and acted accordingly.

Call the roll of the most corrosive services in the treatment plant, and you'll have a good check list of the places where wrought iron is solving maintenance problems to the complete satisfaction of users. If you would like to review the use that modern plants are making of wrought iron, and to see some of the performance records that support the choice, ask for our bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations."

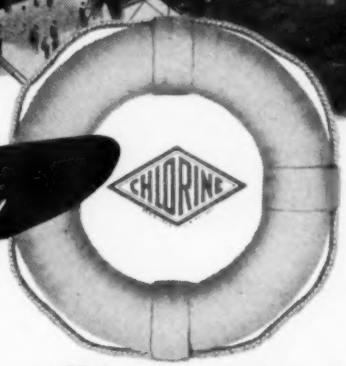
A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

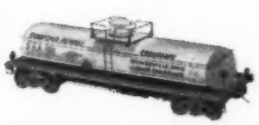
An Employees' Bathing Beach along the River beside your Plant?

Diamond Liquid Chlorine



will help make this New Employees' Activity Possible for your Company

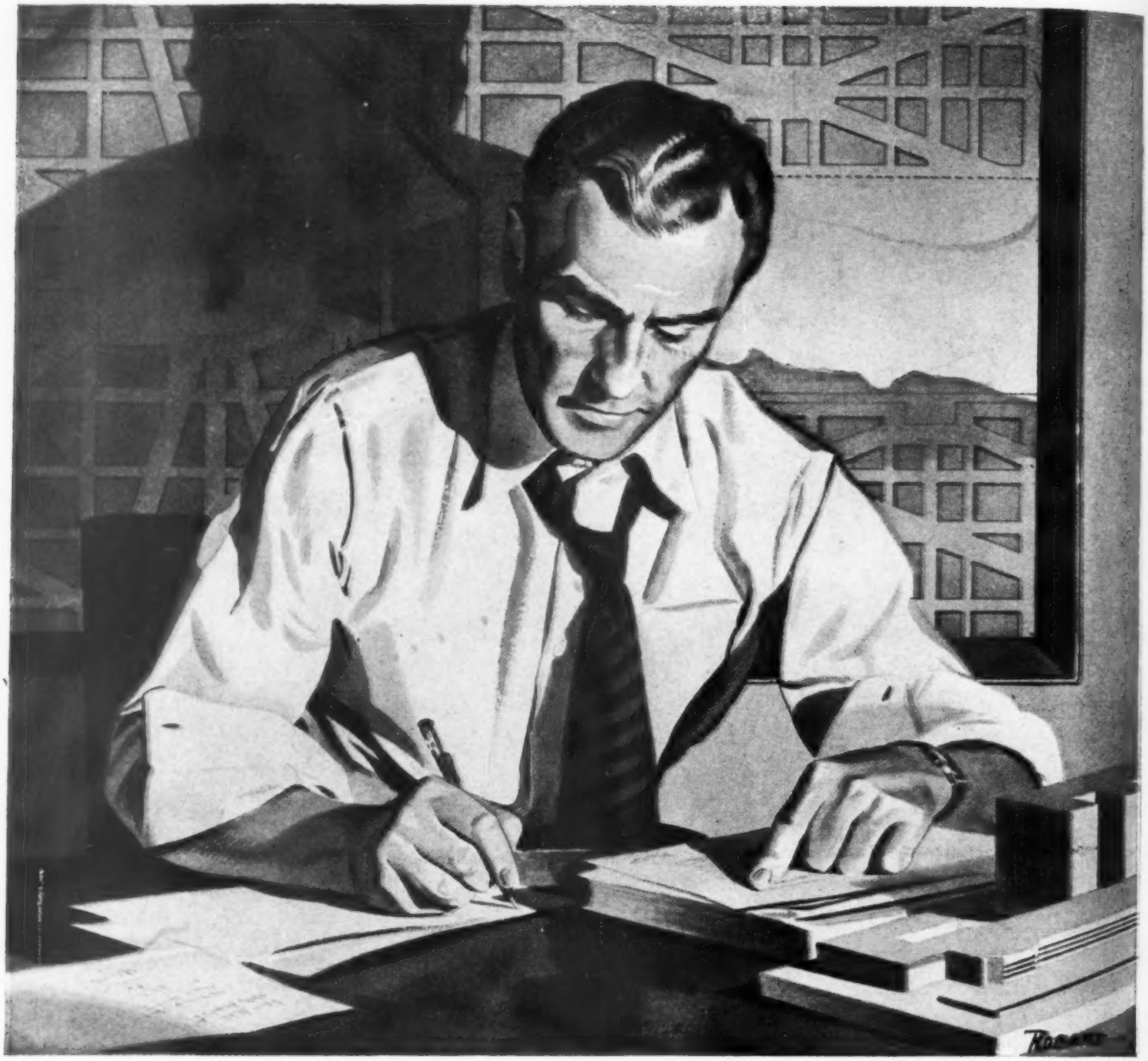
Taking a dip in the cool, refreshing water of the river or stream along side your plant or community, is a definite possibility as the work of federal, state and local committees progresses, toward the elimination of stream pollution. Domestic sewage and industrial waste treatment will be improved through the use of Diamond Liquid Chlorine.



SHIPPED IN TANK CARS

MULTI-UNIT CARS OR

CYLINDERS AS REQUIRED



He is rewriting a page that affects the lives of hundreds of thousands of people

IN A WAY, you might call this a historic moment in the life of a great city.

Without fanfare or ceremony, this farsighted sanitary engineer is helping to rewrite a sanitary code that will improve the living conditions of an entire population.

His revision will make possible the home use of a revolutionary garbage disposal unit—the General Electric Disposall.*

Thus, another public health authority is helping to write "finis" to the era of the garbage can—breeding place for germs and flies.

No, he is not alone in the crusade against filth and disease. Progressive-minded sanitary engineers in more than 300 communities have taken steps to make way for this kitchen device that shreds food waste and flushes it into the sewer *before* it can become odorous, putrefactive garbage.

Wherever necessary, these sanitation authorities have revised antiquated sanitary codes to permit the use of Disposalls in their communities' homes.

Just as sanitary pioneers of another era helped fight epidemics, such as typhoid, by banishing the outhouse

—so, too, are these men helping to rid their communities of another "trouble spot" . . . the garbage can.

We feel certain that, once you have studied all the facts about the Disposall method, you will find it *your* answer to a garbage-free community.

You, too, will want to join the growing ranks of sanitary engineers who are helping to create a cleaner, more healthful, better America!

QUESTIONS AND ANSWERS ABOUT THE DISPOSALL METHOD OF ELIMINATING GARBAGE

1. Has the Disposall method been thoroughly tested?

Yes! Disposalls have been subjected to rigid testing in numerous research laboratories. Moreover, they have been installed in thousands of homes in more than 300 communities. Testing and actual "home" use for more than ten years have proved the efficiency and practicality of the Disposall method of eliminating garbage.

2. Will Disposalls cause sewer system stoppages?

No! The Disposall shreds food waste into such fine particles that they flow freely through the pipe lines without shoaling or settling.

These wastes are finer, more water-buoyant and uniform than sewage solids now flowing through your lines. And they are ground in a controlled amount of cold water, which congeals and homogenizes greases into a form that will not clog sewer lines.

3. Will your plant have to be expanded?

Not for many years will the number of Disposalls in your community become large enough to add appreciably to the loading on the normal treatment plant. Ultimately, even if a Disposall were installed in every home in your community, the volume of sewage flow would be increased by *less than two per cent.*

An increase in solids and organic loading on the plant will naturally result from the addition of food wastes to the sewage flow. But a great many plants will be capable of handling this increased loading for some time; others can be expanded when the loading makes this necessary.

4. Are sewage treatment plants necessary?

As a health-protective measure, there can be no question about the need for treatment plants, whether there are Disposalls in the community or not. We hope that the Disposall method will provide another incentive for building treatment plants wherever they are now needed!

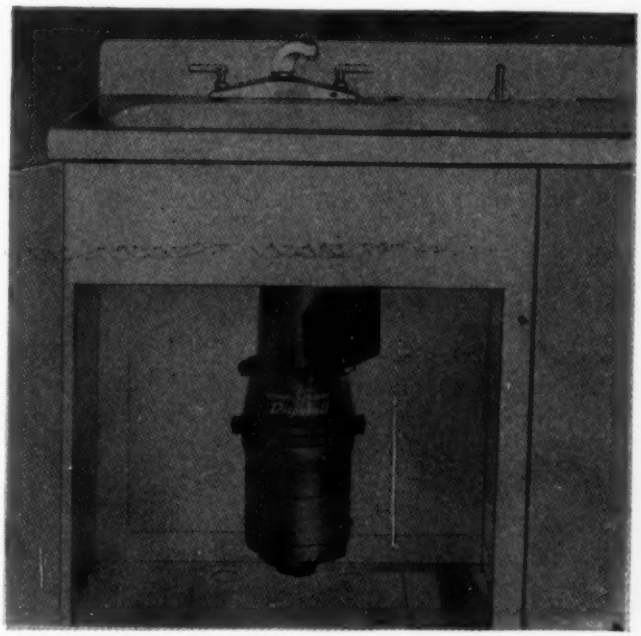
5. Why should garbage be eliminated this way?

Just as indoor plumbing replaced the outhouse, the General Electric Disposall should replace the garbage can. The Disposall removes all food-waste as it should be removed—*immediately!*

Like the outhouse of yesterday, the garbage can threatens community health. It is odorous, putrefactive, germ-breeding. It attracts flies which spread those dangerous germs. *The sooner it is eliminated, the safer!*

6. Where can you get more information?

Further information about Disposalls—and the Disposall method—is yours for the asking. We shall be glad to send complete information—the result of intensive research. We shall be glad, too, to answer any specific questions you may want to ask. Please write to Department WSW 348, General Electric Company, Bridgeport 2, Connecticut.



The General Electric DISPOSALL shown installed in our Electric Sink. Food wastes are scraped into drain opening and safety cover is placed in position. Cold water tap is then turned on, starting the DISPOSALL operation. Food waste is shredded and flushed away automatically.

Disposall

*TRADE-MARK REG. U. S. PAT. OFF.

CONVERTS FOOD WASTE TO SEWAGE—ELIMINATES "GARBAGE"

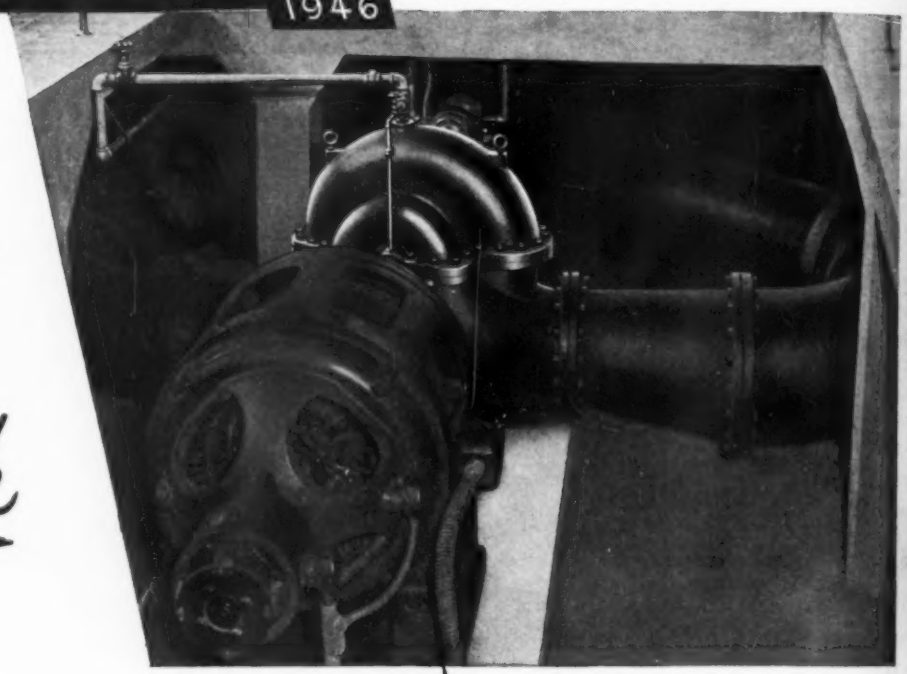
GENERAL ELECTRIC

Sustained Efficiency Year after Year

De Laval geared, turbine-driven, dual pumping unit installed at the Moore's Bridge Pumping Station in 1907.

Brings Repeat Orders Year after Year

A recent installation at Moore's Bridge Station, a 15 mgd, 165 foot head, De Laval unit.



DE LAVAL PUMPS AT *Norfolk*

The City of Norfolk, Virginia, is served by a total of 20 De Laval Water Works pumps, all of which have rendered exceptionally satisfactory, trouble-free and efficient service. In fact, the very first installation, a De Laval geared turbine-driven pumping unit, installed at the Moore's Bridge Station in 1907, is still going strong after 39 years of use.

In Norfolk and elsewhere, De Laval pumps have been noted for the maintenance of high efficiency year after year, a characteristic resulting in a large measure from the use of De Laval Labyrinth wearing rings which minimize internal leakage from discharge to suction while at the same time permitting ample clearances but little affected by wear.

Sales Offices Atlanta • Boston • Charlotte • Chicago • Cleveland • Denver • Detroit • Edmonton Helena • Houston • Kansas City • Los Angeles • New Orleans • New York Philadelphia • Pittsburgh • Rochester • St. Paul • Salt Lake City • San Francisco Seattle • Toronto • Tulsa • Vancouver • Washington, D. C. • Winnipeg

DE LAVAL

DE LAVAL STEAM TURBINE COMPANY • TRENTON 2, N. J.

WW-1

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS AND COMPRESSORS • IMO OIL PUMPS

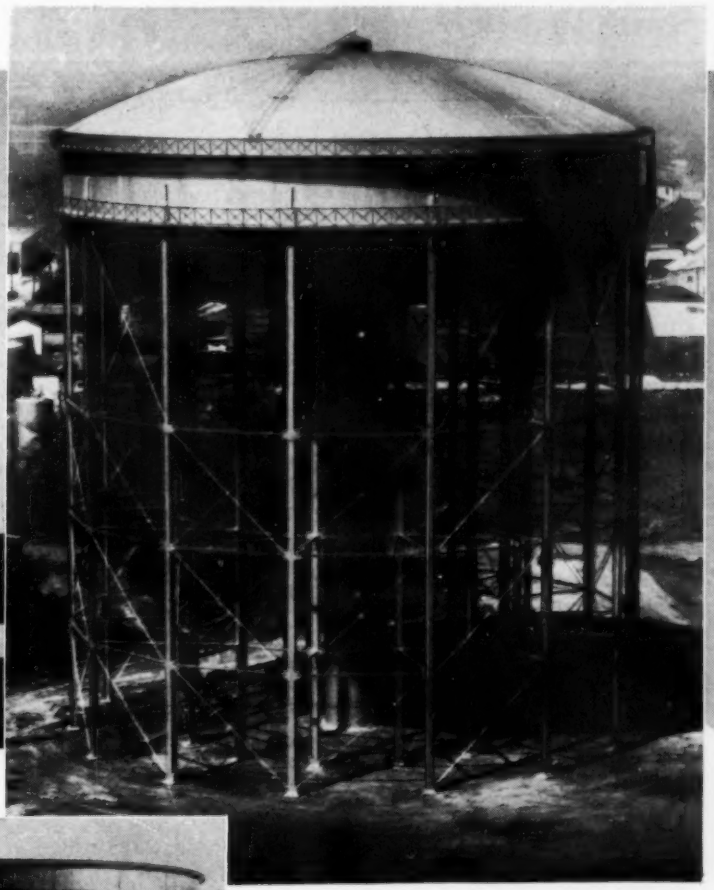
Long-Term Assets to the Modern Waterworks System . . . . .

for EFFICIENT SERVICE · LOWER MAINTENANCE · GREATER DURABILITY

Pittsburgh-Des Moines

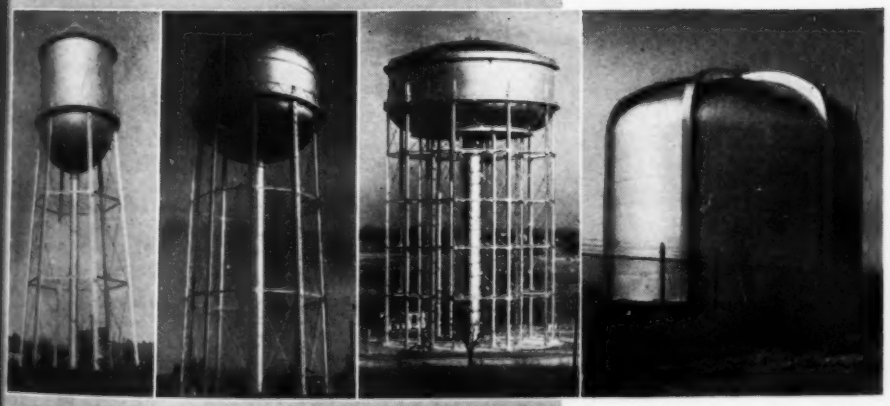
ELEVATED STEEL TANKS

and STEEL RESERVOIRS



1,500,000 gal. toroidal bottom tank; structural tower. Diameter 103'4", head range 25', height to bottom 85'. Fort Dodge, Iowa.

Two 3,000,000 gal. steel reservoirs, diameter 144', height 25'. Berryville, Va.



300,000 gal. cone roof, hemispherical bottom tank, 118' to top. Stillwater, Okla.

500,000 gal. double ellipsoidal tank, on 100' tower. Mission, Texas.

1,000,000 gal. toroidal bottom tank; diameter 76'9", height 127', head range 30'. Keokuk, Iowa.

2,200,000 gal. steel reservoir; ellipsoidal roof; ornamental pilasters. Diameter 80', height 51'. Midland, Tex.

The choice of elevated steel tank or steel reservoir depends largely upon local land elevations. The choice of PITTSBURGH-DES MOINES as designers, fabricators and erectors of your required units is equally logical: you benefit by a half-century of experience in this type of construction, and a guarantee of complete satisfaction with each installation. *May we consult on your water storage needs?*

A NEW PITTSBURGH · DES MOINES STEEL FABRICATING PLANT at SANTA CLARA, CALIFORNIA

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH.....3418 Neville Island
NEW YORK.....Room 918, 270 Broadway
CHICAGO.....1222 First National Bank Building
DES MOINES.....919 Tuttle Street
DALLAS.....1223 Praetorian Building
SEATTLE.....526 First Avenue, South
SANTA CLARA, CAL.....625 Alviso Road

Advertisement

March, 1948

R-S valvEvents

ISSUED PERIODICALLY BY R-S PRODUCTS CORPORATION, PHILADELPHIA 44, PA., FOR THOSE CONCERNED WITH FLOW CONTROL AND SHUT-OFF

R-S Valves Help to Raise Republic Pig-Iron Output

Drawing herewith shows section of a new installation in the Republic Steel plant at Buffalo. A 12-inch R-S Valve acts as an air-blast relief to protect the turbo-blower from excessive pressures.

This is a 125-pound R-S Valve with 125-pound American Standard flanges. Body and vane are made of R-S "H" metal for resistance to temperatures of 250° to 350° F. The valve is opened and closed by a diaphragm top which in turn is actuated by a pressure controller adjusted to open the valve at 40 p.s.i. and close it when pressure drops below 39 p.s.i.

The importance of the installation is shown by the following quotation from a recent issue of the Buffalo, New York, EVENING NEWS:

REPUBLIC STEEL SPENDS MILLION ON BLOWER TO RAISE PIG-IRON OUTPUT

The Republic Steel Corporation's Buffalo plant is spending approximately $1,000,000 to increase production of much-needed pig iron by installing a high-pressure blowing system in one of its two blast furnaces, Manager Frank C. Farrell announced today.

"The high-pressure blowing system will increase the output of the 900 ton-a-day furnace by about 20%," Mr. Farrell said. "Over-all iron production in the plant," he said, "will rise to about 1800 tons a day when the installation is completed in March from about 1650 tons at present." "About two tons of steel can be made from one ton of pig iron, when the latter is used with scrap, so the expansion of our iron production will enable us to produce about 300 tons more of steel per day."

Foundations for installations in the high pressure (air) blowing system are under construction. New equipment will include a powerful turbine, which will increase the amount of air blown into the furnace from 60,000 cubic feet a minute to 90,000 cubic feet a minute.

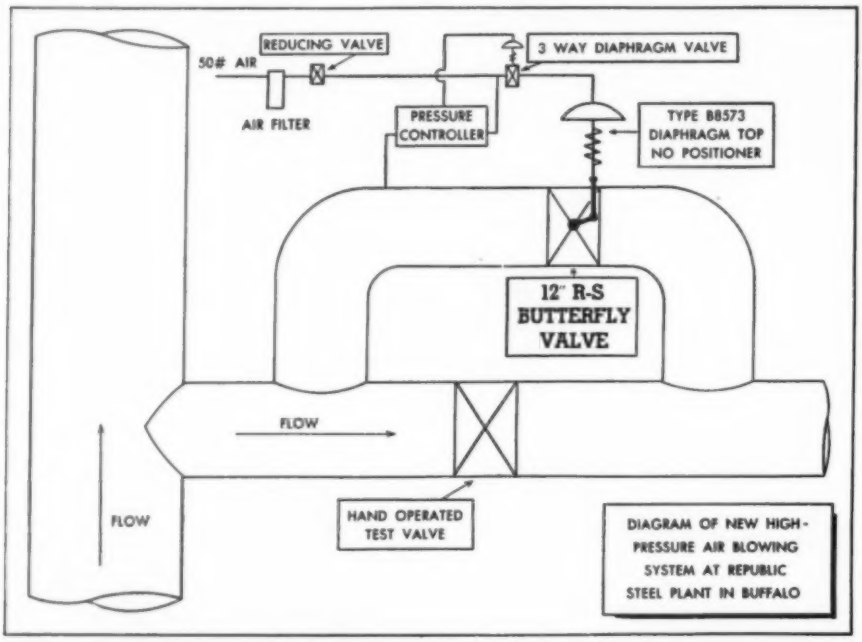


DIAGRAM OF NEW HIGH-PRESSURE AIR BLOWING SYSTEM AT REPUBLIC STEEL PLANT IN BUFFALO

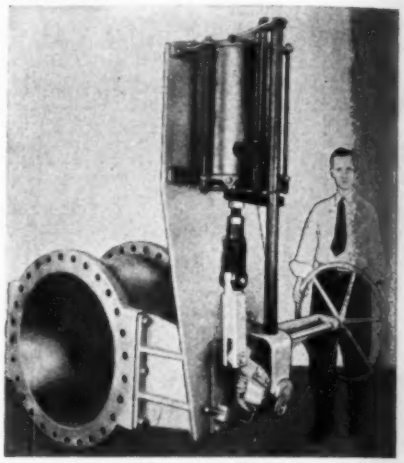
R-S Rubber Seated Valve Takes Terrific Beating

"Doc" Crane, R-S representative at Buffalo, recently arranged a test of an R-S rubber-seated valve for Electro Metallurgical Company, Division of Union Carbide & Carbon. The test involved upwards of 30,000 full closings. The R-S rubber-seat took the beating, as reported by Mr. C. G. Chadwick of Electro-Met, and we gratefully took the order.

The R-S rubber-seated valve for drop-tight closure is fully described on Page 40 of the new R-S Valve Catalog #47.

Big R-S Valve Controls Water Level in Reservoir

Picture shows an R-S 30-inch 125-pound cast iron valve of Type 501 for control of water level in a reservoir. 8" x 10" air cylinder positioner uses 100 p.s.i. operating air in connection with 0 to 15 pounds instrument air and positions valve accurately through operation of a liquid level controller.



R-S heavy duty handwheel with self-locking worm and gear and de-clutching mechanism provides for manual operation. Gooseneck at right provides additional outboard bearing on operating shaft.

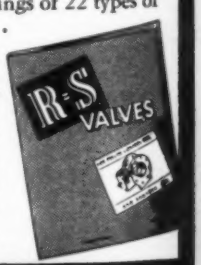
Leveltronic Control Catalog

The Electronic Division of R-S Products Corporation announces its new Catalog #27 on its Leveltronic Relay for control of liquid level, interface, pressure, flow, temperature, high foam, and many other applications.

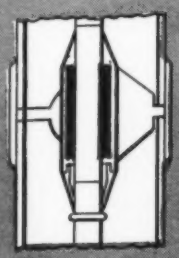
The New R-S Valve Catalog #47

R-S Valve Catalog #47 is packed with information for engineers. There are over 70 halftone pictures of R-S Valves . . . working drawings of 21 types of R-S Valves with standard controls and fittings and complete dimensional data for all sizes . . . working drawings of 22 types of prime movers . . . numerous other diagrams, graphs, and miscellaneous drawings. Address R-S Products Corporation, Valve Division, Philadelphia 44, Pennsylvania.

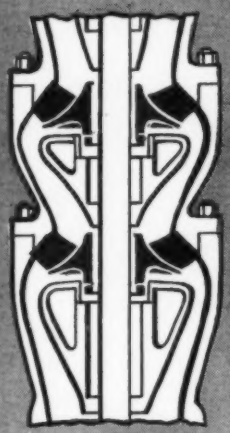
JMLco P-CC2



EASY ADJUSTABILITY. With one simple "at the surface" adjustment, you can vary capacities over a wide range without power-wasting "throttling." Adjustment nut can also be used to compensate for wear . . . assuring new pump efficiency for the lifetime of the pump!



QUIET, SMOOTH OPERATION. Pomona's revolvable rubber shaft bearings assure vibration-free shaft support under all conditions.



FREEDOM FROM SAND-LOCKING. You won't have any costly stoppages with Pomona. Open impeller design assures complete freedom from sand-locking . . . minimizes wear . . . eliminates the need for sealing or wearing rings.

WATER LUBRICATION. Pomona's true water lubrication is your guarantee of clean, clear water. Water lubrication also means simplicity of design with fewer working parts for maximum dependability, lower operating costs, less maintenance.

IT isn't just chance that Pomona gives you all the features you've always wanted in a vertical turbine pump. Lowest-cost-per-gallon service . . . unequalled dependability . . . simplicity of installation and maintenance, these are "designed-in" features resulting from years of experience. Just check these features. You'll find what you want!

WANT GET

POMONA!

CHECK THESE and other "wanted" Pomona features with your Fairbanks-Morse Pomona dealer or branch pump engineer. They can show you how the Pomona line . . . sizes from 4 to 36 inches, capacities from 15 to 20,000 G.P.M. . . . gives you more!

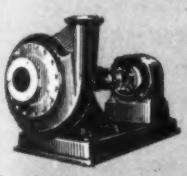
Fairbanks, Morse & Co., Chicago 5, Ill.

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • PUMPS • SCALES • MOTORS • GENERATORS
STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT • MAGNETOS

A FEW OF THE COMPLETE LINE OF FAIRBANKS-MORSE PUMPS



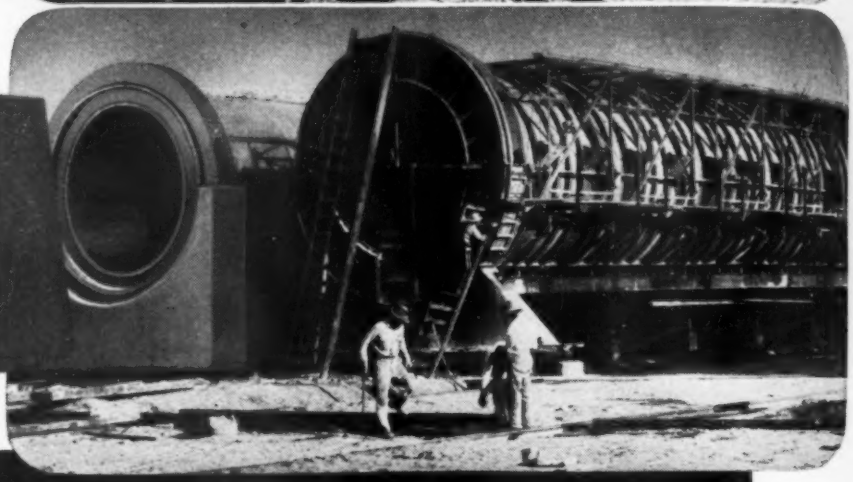
Trash Pumps

Side-Suction

Centrifugals

Builtogether

Whether it's a
12 in. pipe



or a
12 ft. pipe

CONCRETE
makes the ideal pipe

SMALL LATERAL SEWER or the world's largest pipe (12 ft. I. D. x 100 feet long, installed in the Los Angeles ocean outfall sewer at Hyperion) concrete pipe fits any sewerage, drainage or water line need as proved by its use in hundreds of communities throughout the nation.

Concrete pipe can be designed for practically any combination of engineering requirements and local or climatic conditions. When you specify concrete pipe you get:

STRENGTH AND DURABILITY to resist severe impact, to sustain heavy overburdens and to render long years of continuous, dependable service.

MAXIMUM HYDRAULIC CAPACITY because of its smooth interior finish; its clean, even joints, and the absence of tuberculation.

HIGH WEAR RESISTANCE to abrasion by suspended grit in high-velocity flow.

MINIMUM INFILTRATION AND LEAKAGE because of tight joints and uniformly dense concrete.

ECONOMICAL SERVICE because its moderate first cost plus its long life and small maintenance expense result in ***low annual cost,*** the true measure of economy and the taxpayers' goal.

These qualities make concrete the efficient, economical pipe material.

PORTLAND CEMENT ASSOCIATION

DEPT. 3-29 • 33 W. GRAND AVENUE • CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work

INSURES PALATABLE AQUA NUCHAR DRINKING WATER

Top Performance

AQUA NUCHAR gives top performance among Activated Carbons because of its exceptionally high porosity and resultant extraordinary adsorptive properties.

This tremendous internal and external surface area also accounts for its superior dispersion and suspendability—assuring that microscopic particles contact **all** of the taste and odor impurities for a **longer** period of time. These impurities are then retained in the carbon and are eliminated when the carbon is removed. Thus, the action of AQUA NUCHAR is a physical rather than a chemical one, and an overdose can have no ill effects such as may be encountered with the usual water works chemicals.

The Technical Service Department at our nearest sales office will be glad to discuss your taste and odor problems with no obligation on your part.

industrial CHEMICAL SALES

division west virginia pulp and paper company

NEW YORK CENTRAL BLDG.
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PURE OIL BLDG.
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LEADER BLDG.
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CLEVELAND 14, OHIO

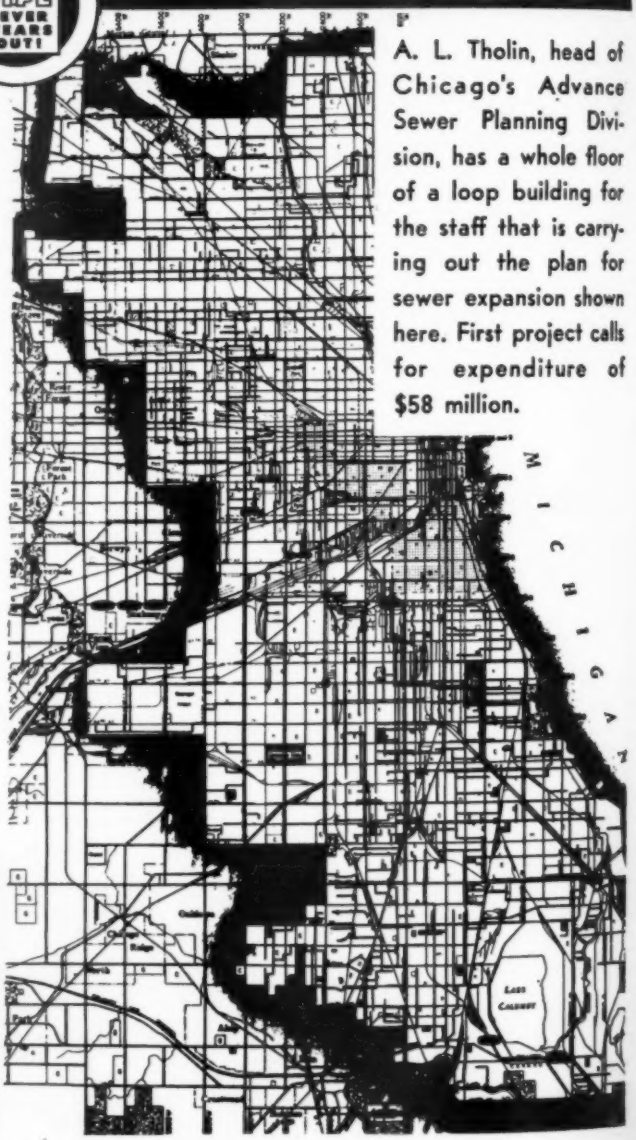
...And Still Chicago Grows

WITH PERMANENT, SAFE CLAY PIPE INSTALLATIONS

CLAY PIPE NEVER WEARS OUT!

EVER since Mrs. O'Leary's cow kicked up the big fuss back in 1871, Chicago has been *growing*. From a population of less than 300,000 on the date of that terrible disaster, the famous Windy City has marched along to a hefty 3,500,000.

Vitrified Clay Pipe has played an important role in this past expansion, and in hundreds of current developments. For engineers know that Vitrified Clay Pipe is the only sewerage and drainage pipe impervious to the action of corrosive materials, acids, ground and sewage alkalies. *In all the history of Chicago's building, there has never been a single instance where Clay Pipe has worn out!* If you need specific information on Clay Pipe, write the details to the office nearest you.



A. L. Tholin, head of Chicago's Advance Sewer Planning Division, has a whole floor of a loop building for the staff that is carrying out the plan for sewer expansion shown here. First project calls for expenditure of $58 million.

NATIONAL CLAY PIPE MANUFACTURERS, INC.

522 First National Bank Building, Atlanta 3, Ga.
1105 Huntington Bank Building, Columbus 15, Ohio
111 W. Washington Street, Chicago 2, Illinois
703 Ninth and Hill Bldg., Los Angeles 15, California

C-348-1

"Our last figures showed Badgers the lowest in maintenance costs"

. . . wrote a Bureau of Water Superintendent to another city's Board of Water Commissioners, and then went on to say:

"We have standardized on Badger Meters and find them very satisfactory . . . most economically priced for first cost as well as low in maintenance cost. Further, I have found these people a good concern to deal with."

Badger Meters improve your "customer relations," increase your prestige with taxpayers, assure continued accuracy in registration of all water used. It pays to BUY BADGER.

BADGER METER MFG. CO., MILWAUKEE 10, WIS.

Every water works superintendent should have a copy of our chart:
"RELATIVE CARRYING CAPACITIES OF PIPE LINES", No. 668
Send for yours today (no charge)

BADGER Water METERS

ACCURACY · LOW COST MAINTENANCE · DURABILITY · SENSITIVENESS

BRANCH OFFICES:
NEW YORK CITY • PHILADELPHIA • WORCESTER, MASS.
SAVANNAH, GA. • CINCINNATI • CHICAGO • KANSAS CITY, MO.
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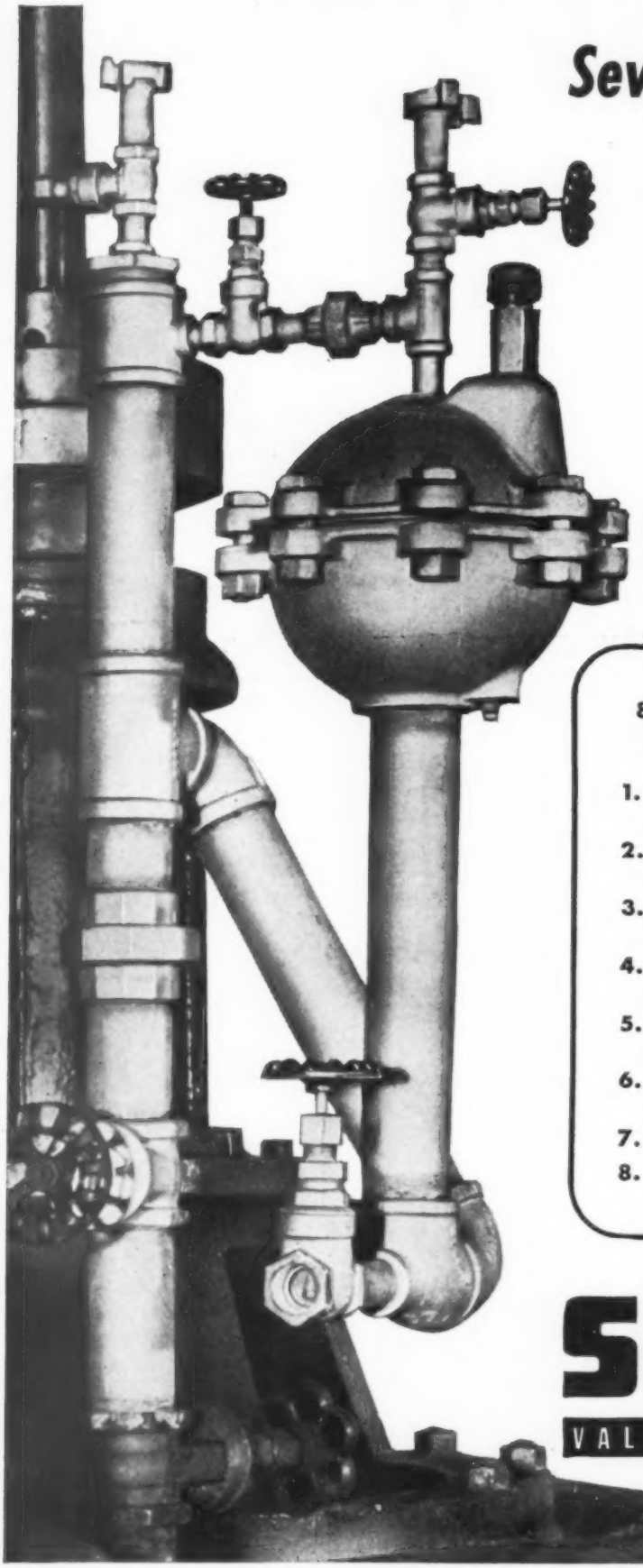
SIMPLEX



Sewage Air Release Valve

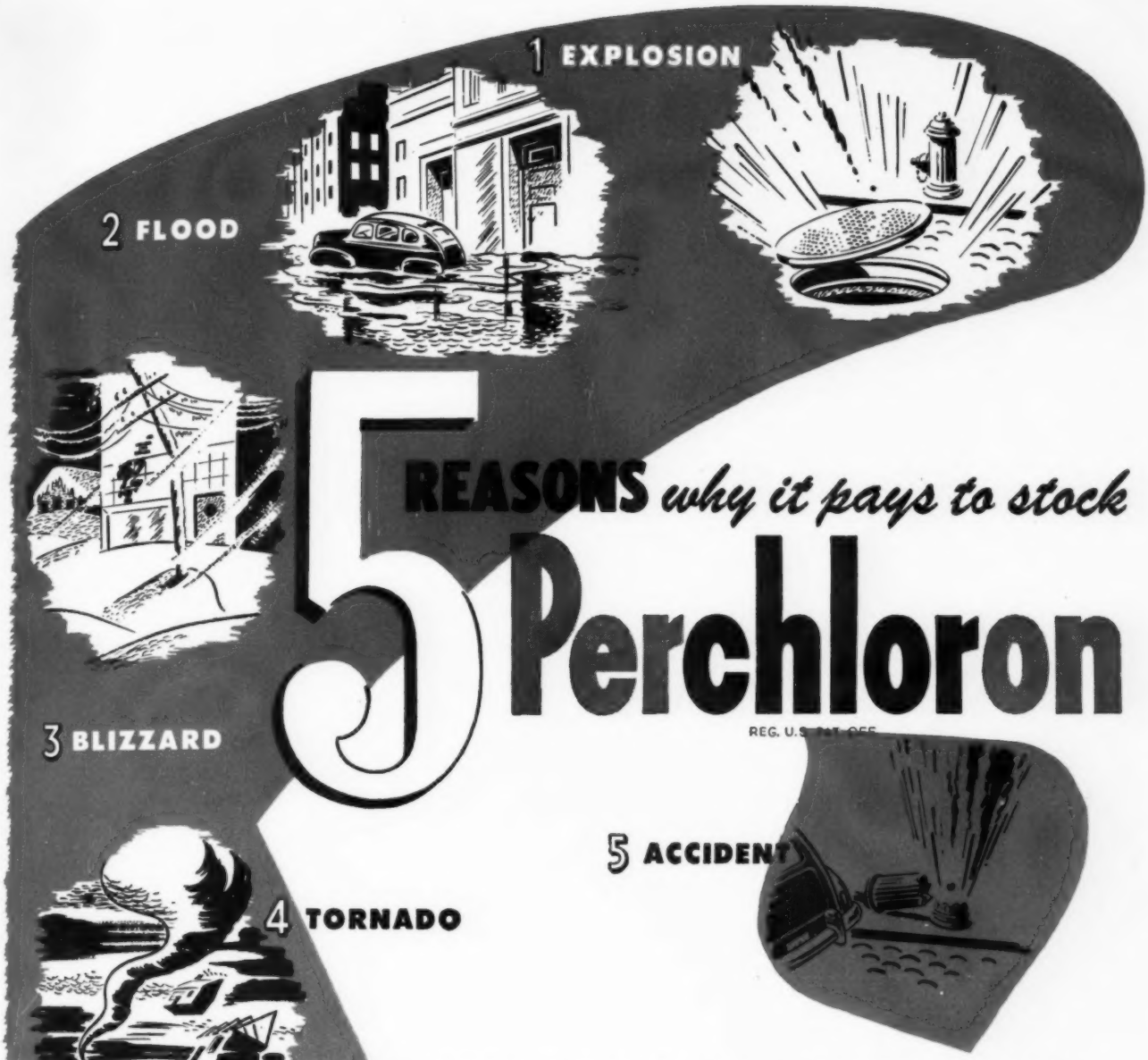
. . . rids air accumulations automatically and frequently from pipe lines carrying sewage or other solid matter. By virtue of its construction this type of valve can be mounted on sewer lines or on sewage pump casings. Flushing and cleaning of the internal working parts of the valve can take place at any time when Simplex's Sewage Air Release Valve is equipped with an approved type back flushing device. For full information, write: Simplex Valve and Meter Co., 6743 Upland St., Philadelphia 42, Pa. *Ask for Bulletin 140.*

8 DEPENDABLE, EFFICIENT FEATURES OF SIMPLEX SEWAGE AIR RELEASE VALVE

1. Excess power to insure opening of valve against high internal pressure.
2. A valve seat that is least liable to stick shut or leak water.
3. A non-corrodible float that will not collapse or become disconnected from its lever.
4. Simplicity of construction, easy bearings and few parts.
5. Properly designed outlet port to prevent clogging by deposits of any kind.
6. Provision for back flushing and for draining without dismantling valve.
7. Sturdy construction permitting rough handling.
8. Easy inspection of internal parts.

SIMPLEX

VALVE AND METER COMPANY



5 REASONS *why it pays to stock* Perchloron

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Yes, these sketches illustrate why so many alert engineers maintain a standby supply of Per*chlor*on.

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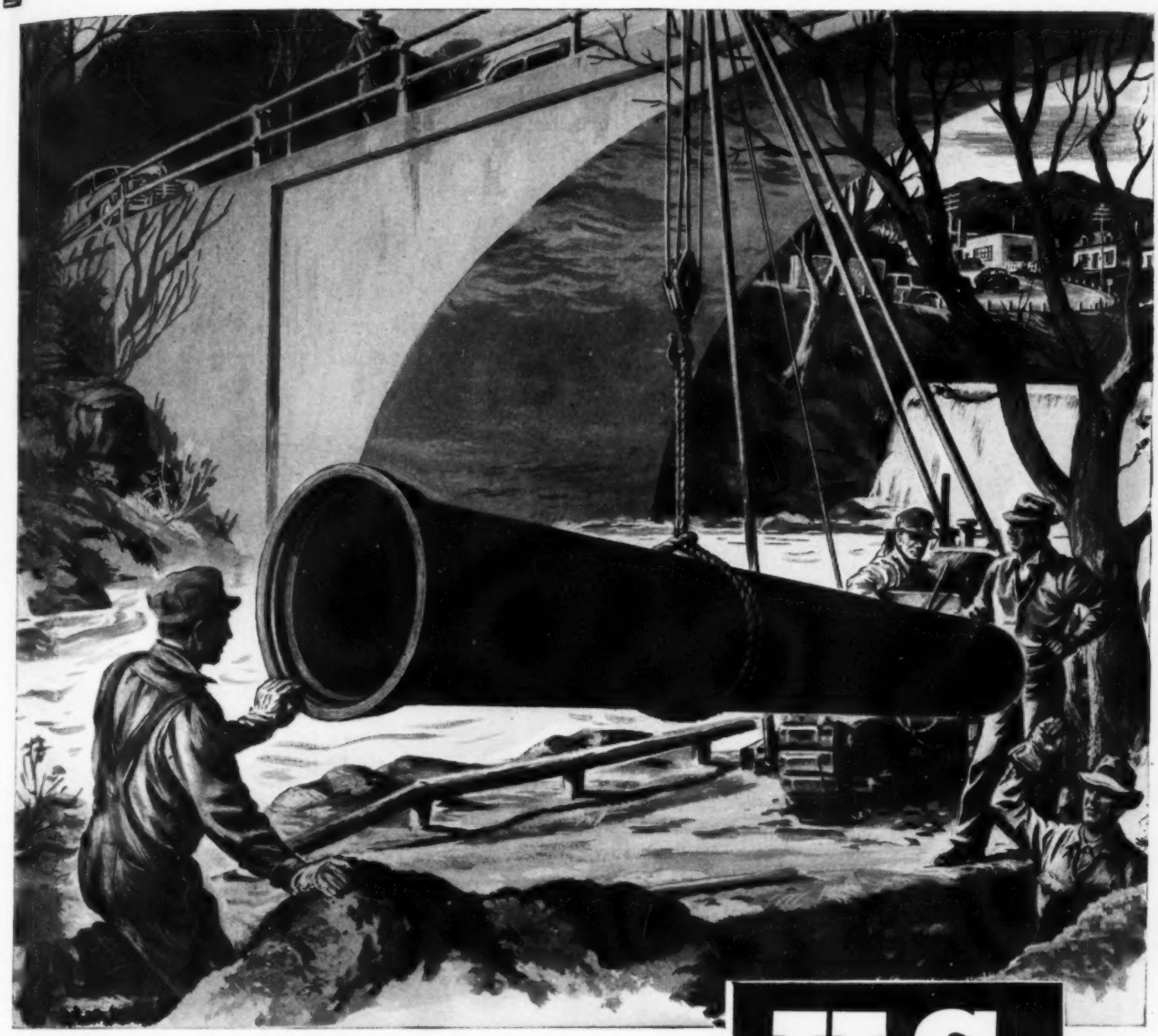

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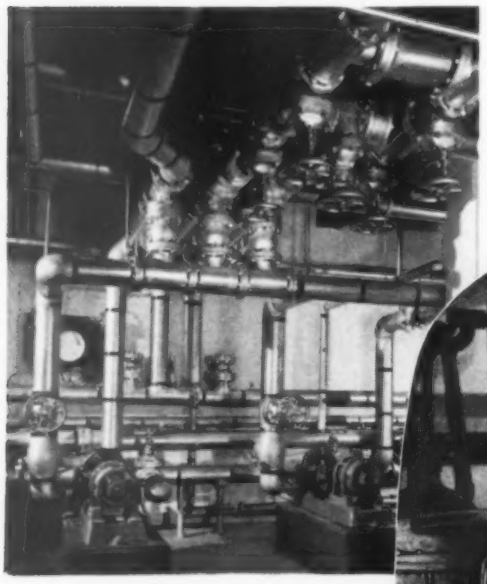

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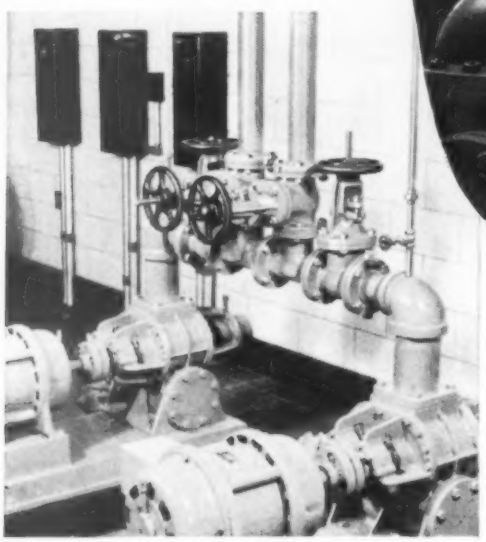

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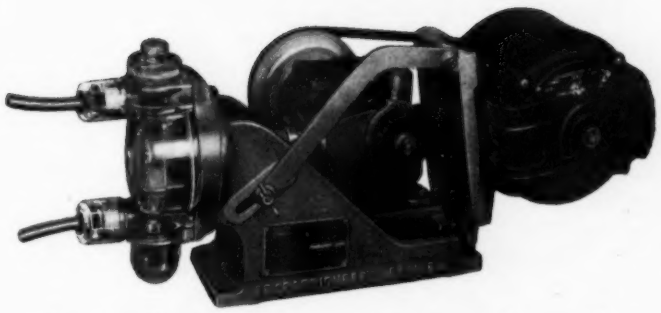

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WATER & SEWAGE WORKS

VOL. 95, NO. 3 MARCH, 1948

A Gillette Publication

THE NEED FOR INCREASED WATER RATES*

By LOUIS R. HOWSON

Alvord, Burdick & Howson, Engineers

CHICAGO, ILL.

ALTHOUGH this article will be concerned primarily with municipal water works, which comprise more than 80 per cent of the 13,000 water plants in the United States, the conclusions reached are equally applicable to privately owned water works. Both types, it is believed, require an increase in rates if they are to continue to furnish satisfactory service and meet and anticipate growing requirements as they have in the past two decades.

It is just as much the obligation of a water utility to provide an adequate amount of money for its orderly expansion as it is to set up a depreciation reserve to guarantee its continuity of service; both should be calculated in terms of the purchasing value of the dollar at the time the expenditure is made. A worn-out boiler, for example, must be replaced by a new one, which cannot be purchased at the same price as the original. Industry is recognizing its growing inability to finance replacements from depreciation reserves computed at normal rates on original cost and, in general, is taking steps to set aside more liberal amounts for this purpose. Water utilities and utility commissions should likewise recognize that it is the property rather than the original dollars that furnishes the service, and it is the property for which adequate depreciation reserves should be provided.

The Author

During the past twenty years investment in water works properties has increased approximately 2½ times as fast as the population. This fact indicates that the demands created by rising standards for water service are a more important factor in determining capital expenditures than is the growth in population.

For several years it has been common for water works operators to express satisfaction that their gross revenues, and—at least until the last year or two—their net revenues, were greater than ever before. Real concern about the adequacy of water rates has developed only within the past two years, when the impact of rising labor and material costs, combined with more normal maintenance expenditures, increased operating expenses to such an extent that the operating income of most utilities was actually reduced. Even now few seem to realize, at least until they approach some major construction program, that the present water rates will not support the property in the same manner as previously. Water works have joined the "profitless prosperity" to which many industries have been subjected for some time. They might well learn from the more aggressive labor organizations that consideration of what the dollar will buy in terms of the necessities of water works operation and expansion is better evidence of financial stability than the number of dollars revenue taken in.

The water works operator who has not given serious consideration to this phase of the revenue problem has a surprise in store if he is considering a major expansion program or, often, if he merely undertakes to keep up his customary prewar volume of extensions. In seven out of eight water works construction projects with which the author has been connected in the past two years, it has been found necessary to increase the water rates in order to finance the program.

*This paper, presented before the N. Y. Section of A.W.W.A. Jan. 19, 1948, is here published by permission of the Association.

Comparative Price Levels

In a recent article[1] the author pointed out the wide discrepancy between the price level of water and of other commodities. This difference has still further increased. In the period from before the war to December 1947:

1. Wholesale prices increased by 70 per cent (source: U.S. Bureau of Labor Statistics).

2. The cost of living index increased 65 per cent (U.S. Bureau of Labor Statistics—1935-39 = 100).

3. Retail prices increased 60 per cent (U.S. Dept. of Commerce—1935-39 = 100).

4. Factory wages, which are reflected in the cost of commodities, increased 55 per cent (U.S. Bureau of Labor Statistics).

Considering the water utility as a transportation service, the same condition holds true. Freight rates are up 41 per cent, with an additional 10 per cent rise in prospect, but the basic water rates of most utilities are the same as before the war.

Use of Water Works Net Revenues

The best operated municipal water works endeavor—through a careful coordination of requirements, construction programs and available funds—to build from current revenues, as far as possible. As a long-term policy, this method is approximately 40 per cent cheaper than financing through bond issues.

Table 1

WATER WORKS EXPENDITURES, 1940-47*

Year	E.N.-R. Construction Cost Index	Expenditure $1,000,000 units	1940 Dollar Value $1,000,000 units
1940	241.96	127	127
1941	257.84	120	112
1942	276.31	100	87
1943	289.95	70	58
1944	298.64	53	43
1945	307.74	60	47
1946	345.94	97	68
1947	407.12	143	85
TOTAL		770	627

*Federal Works Agency Statistics.

Analyses of a large number of water works have indicated that over the past two decades approximately 25c out of every dollar of revenue, or $1.50 per capita per year, has been expended for plant expansion. In the aggregate, United States water works expended approximately $120,000,000 per year for new construction from 1925 to 1945. During this period the *Engineering News-Record* construction cost index averaged approximately 230 (1913 = 100). In comparison, the average for the year 1940 was 241.96, and for December 1947, 432.

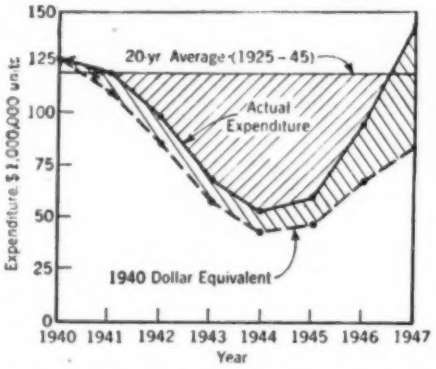

Fig. 1. U. S. Water Works Construction

Shaded area indicates extent of deficiency. Note disparity between dollar expenditures and actual physical units of construction.

In the eight years following 1939 the water works systems of the country expended $770,000,000 for new construction, as shown in Table 1.

This money has been spent in annual amounts varying from $53,000,000 to $143,000,000 during a period in which there has been a continual increase in construction costs—and, accordingly, a decrease in the construction provided for a given expenditure (Fig. 1). The 1940 dollar value of the total expenditure for construction in 1940-47 amounts to only $627,000,000, whereas normal prewar expenditures for water works construction during the eight years would have totaled $960,000,000. It is apparent, therefore, that there is a deficiency of $333,000,000 in water works construction (on a prewar cost basis) since 1940. This is shown graphically by the shaded area in Fig. 1. It would have required the expenditure of $600,000,000 in 1947 to make up this deficiency.

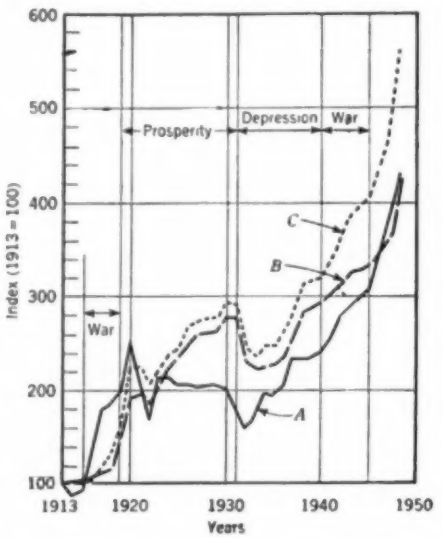

Fig. 2. Wage Rates and Construction Costs (1913 = 100)

A—E.N.R. construction cost index.
B—Hourly wage rate, all building trades.
C—Hourly wage rate, laborers and helpers.

At 1947 price levels, the construction normally built before the war, at an annual expenditure of $120,000,000, would cost approximately $225,000,000. If a normal rate of water works construction is undertaken now, and, in addition, the accumulated deficiency of the last eight years is spread over a five-year period, an annual capital expenditure of $345,000,000 a year—or 62½ per cent of the annual gross revenue of the water works systems of the country—would be required. This is 2½ times the percentage of gross revenue expended for new construction in the period between the two world wars. But operating expenses are rising and now consume more than 54 per cent of the gross revenue. It is obvious that a capital expenditure rate of $345,000,000 a year could not be maintained without increasing revenue at least by the difference between $345,000,000 and $120,000,000, i.e., $225,000,000 per year. This would be equivalent to about 40 per cent.

If the accumulated lag in water works construction is spread over ten years in the future, instead of five as computed above, the annual capital expenditure for new construction would be $285,000,000, which is 55½ per cent of the gross revenue. To finance such a capital outlay would require an increase of approximately one third in revenue.

Even if no attempt is made to compensate for the construction deferred during the war period, an increase of about 20 per cent in revenue is indicated as necessary to provide the same facilities as before the war. This is probably an underestimate, as it assumes that the full impact of wage increases was reflected

in 1946 operating statistics. Obviously, to maintain the same standard of service and growth, water rates must be increased.

A water works operator recently remarked to the author that since the water utilities had not been able to spend $333,000,000 of the amount which would normally have been expended in the last eight years, they should have it on hand now and would therefore need no increase in revenues at present. But this argument overlooks the fact that it is *facilities* rather than dollars which provide adequate service, and that this sum would have provided in 1947 only a little more than half the facilities purchasable at prewar prices. Thus there would either be a 50 per cent shortage in needed new facilities or an additional $270,000,000 would have to be furnished to make up the $600,000,000 present cost.

Further discussion with the water works operator brought out that his city had accumulated $1,200,000 during the war period, which had recently been set aside for pipe, valves and hydrants for deferred distribution system expansion, but that funds would not be available to install the material when it arrives some months hence.

Water works net from operations has increased, on the average, about 11 per cent since 1940. In the same period construction costs have increased 80 per cent. Because construction must be financed either directly from earnings or indirectly from the sale of bonds, with interest and amortization provided from earnings, it is apparent that the 1947 ability to build—or the amount of new facilities which the water works net will finance—is but 111/180, or 60 per cent as much as in 1940.

In Wisconsin, where the Public Service Commission reports that the 1946 operating income of all water works in the state is 35 per cent above 1939, the ability to finance new facilities is 135/180, or 75 per cent as great as in 1939. It might also be noted, incidentally, that the degree by which net income for all Wisconsin water works exceeded 1939 levels dropped from 43 per cent in 1944 to 35 per cent in 1946.

Future Construction Costs

Whether construction costs will remain at the present level is best determined by analysis of the major factor in all construction—the cost of labor.

Construction is always individual. It does not lend itself to production-line methods. All water works structures, and most other kinds as well, are "custom built."

The close relationship between labor rates and construction costs is shown in Fig. 2. Based on an index of 1913 = 100, the average of hourly wages (all building trades) (laborers and helpers) stood at 500 in December, 1947. The E.N.-R. construction cost index of the same date was 432.3, thus reflecting (hourly wages) 86½ per cent of the labor wage increase.

This close relationship also exists during periods of decreasing labor and construction costs. From 1930 to 1932 construction labor wages dropped 30.5 per cent, while the E.N.-R. construction cost index dropped 23.1 per cent.

In the long upswing beginning in the summer of 1932, construction wages increased 254 per cent and the E.N.-R. construction cost index climbed 284 per cent.

The fallacy of the belief that wages can be raised without affecting costs is apparent in the construction industry, where the relationship between hourly wages and building costs is practically a direct one. As a result of this fact, in combination with the national trend in wages, there are fewer and poorer structures being built.

Construction costs in December 1947 were approximately 85 per cent above the pre-World War II level. Some light is thrown on the future by a comparison of construction costs following the termination of hostilities in both world wars (Fig. 3).* If the similarity between the two postwar trends continues, the time at which a break in construction costs may be expected is not too far distant. It must, however, be recognized that World War II was much longer and more devastating than its predecessor, that price controls were in operation during and after World War II and that union labor is much more firmly entrenched now than it was after World War I.

It is believed there will be some recession in costs as the influence of black markets in materials and labor is dissipated by more abundant supplies and labor becomes more efficient, but any reduction from the present

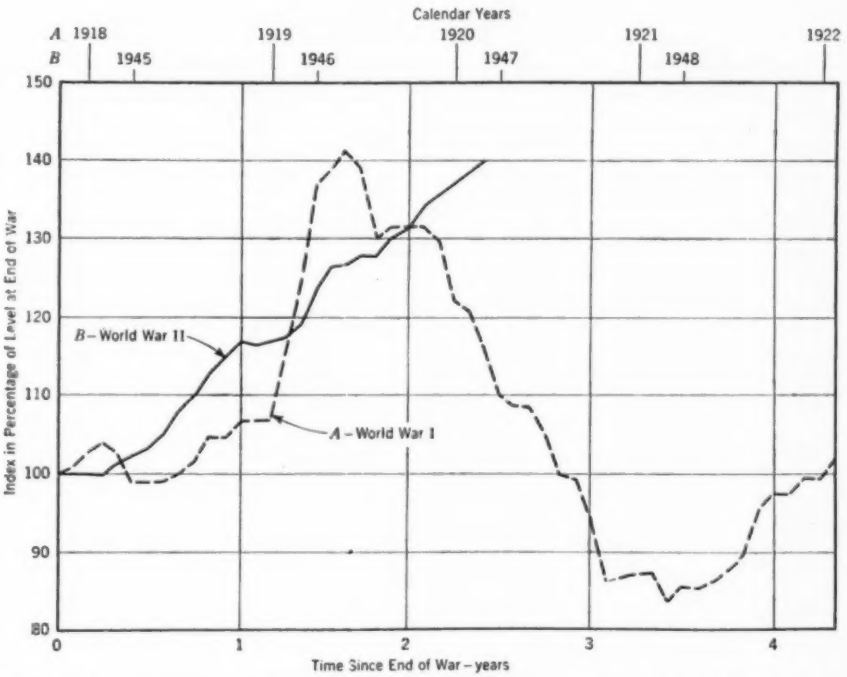

Fig. 3. Comparison of Construction Cost Indexes After World War I and World War II

*A similar comparison of postwar construction costs, including the Civil War, appears in a previous article by the author[1].

levels will not exceed approximately 20 per cent, except in building construction.

We must be realistic. Prewar prices will never return. Water works rates necessarily have to operate in the future, and the construction of additional facilities is also a future consideration. Good management recognizes the interrelation between construction requirements and adequate revenues. To meet the construction requirements of the next decade (excluding facilities immediately necessary) it seems prudent to base programs upon costs estimated to range from 60 to 75 per cent above those prevailing in 1939. Construction which cannot be deferred and must be built in 1948 should be estimated to cost from 80 to 100 per cent above 1939, the higher percentage being applicable to projects involving a relatively large proportion of building construction, where the inefficiency of labor and "feather-bedding" practices have resulted in costs materially above those indicated by the indexes.

Increased Rate Requirements

First, let us consider the utility in which the face value of the net earnings available for new construction is as high as before the war, when $1.50 per capita was expended for improvements each year. At present construction costs, it would require from $2.75 to $3.00 per capita to provide facilities equal to those formerly built for $1.50, indicating an annual per capita increase of $1.25 to $1.50, or 20-25 per cent. But in most water works plants there has been a decrease in net income for the past two or three years.

Water works revenues, as evidenced by the statistics of 100 water works properties, average approximately $32 per year per customer. Prewar operating expenses before depreciation averaged approximately $17.50 per year, leaving an operating income before depreciation of $14.50 per year. Operating costs, including fuel, labor and maintenance materials, have already increased or are generally in the process of increasing to such an extent that the annual net income is reduced from $14.50 to approximately $10.00 per customer. Of the $14.50 per customer per year, approximately half has been spent for new construction and the rest for fixed charges, return, depreciation and so forth. Assuming that the fixed charges will remain constant, the amount left for new construction will be decreased from approximately $7.50 to $3.00 per customer per year. But even an annual expenditure of $7.50 per customer would not purchase nearly the amount of new facilities as in the prewar period. To match these facilities would require approximately $13.50 at the present time. Since only $3.00 is available, that would necessitate an increase of $10.50 per customer, which is approximately 33 per cent of the gross revenue. This, of course, gives no consideration to the accumulated deficiency of construction since 1940.

By and large, it is believed that the water works systems of the country must have a rate increase averaging approximately 30 per cent, if they are to progress and improve their standards of service to the same extent as during the past two decades.

Actual Rate Increases

Although most of the 13,000 water works have done nothing about increasing rates, a considerable number — particularly those faced with the necessity of large capital expenditures— have studied their revenue requirements and sought relief.

St. Paul, Minn., increased rates on February 1, 1947, by 10-45 per cent, an over-all average of 25 per cent. Syracuse, N. Y., adopted a 50 per cent increase in 1947. A midwest private utility company which operates sixteen water works has secured rate increases, through the public service commission, averaging 31 per cent for fourteen of the sixteen properties. Numerous applications are being prepared. It is hoped that those water works which need increased revenues and require utility commission approval will not be subjected to lengthy valuation hearings. The commissions should at least grant temporary or interim increases based upon a proper showing of necessity from operating records and requirements for capital expenditures.

Reference

[1]Howson, Louis R.—Adjusting Rate Structures to Rising Cost Levels—*Journ. A.W.W.A.* 39:819 Sept. 1947). Also *Water & Sewage Works*, 94:307 (Sept. 1947).

BACKMEYER HEADS MARION, IND., WATER AND SEWAGE UTILITIES

Another sewage treatment works superintendent has joined the ranks of the "dual personality boys." David B. Backmeyer, Superintendent of the Marion, Indiana Sewage Treatment Works since its construction, was recently appointed to the position of Joint Superintendent of both the waterworks department and the sewage treatment works of that city.

Under Backmeyer's management of the sewage treatment works, the plant has received a rating of one of the six finest in the middle west, regardless of size.

Backmeyer, whose article in *Water & Sewage Works* on gas engine operation has received considerable attention, is a graduate of Wittenberg College with majors in mathematics and chemistry. He also attended the University of Michigan, where he studied in the graduate school.

In May, 1940, Backmeyer went to work in Marion to manage the sewage treatment plant. He received the Indiana State Sewage Works Association award for meritorious service in 1943, and in 1945 was awarded the Junior Association of Commerce Award in Marion.

In his new position, Backmeyer has an executive assistant in the water department who is the city engineer, and in the sewage treatment works Backmeyer also has an assistant.

HYDRAULICS FOR THE PRACTICAL WATER WORKS MAN

The Fourteenth of a Series of Articles

Pressures in Pipes Due to Sudden Changes of Flow—Water Hammer

By ROBERT W. ANGUS, M.E.*
Consulting Engineer
TORONTO, CANADA
*(*Prof. Emeritus of Mechanical Engineering, University of Toronto)*

UP to the present this series of articles has dealt with hydraulic problems ordinarily met with in the water works field. Throughout, it has been assumed that the flow was steady and uniform, and that there was constant discharge, a condition always assumed in design. In operation, however, the flow is often variable due to the opening of a hydrant or even of a number of householder's faucets, although in the ordinary course of events the householder draws water at such a low rate that the system is little affected by the way the individual draws water. The house piping, on the other hand, is affected by careless operation of faucets which causes troubles and leaks in domestic plumbing.

The Author

But hydrants may draw very heavily on the distribution piping, as may also the supplies used by railroads, and if these are closed off rapidly dangerous pressure rises may occur. Under certain conditions the pressure rise is accompanied by a click, such as would result from striking the pipe with a hammer, and this phenomenon has received the name of "water hammer." An attempt will now be made to examine this matter briefly, although this must be done in a somewhat superficial way on account of the complexity of the subject.

In the first place it is to be noted that the pressure *rise* will depend upon the *rate* at which the valve or hydrant is closed and the velocity "extinguished." If, for instance, the velocity in a pipe supplying an open hydrant is 4 ft. per sec. and if this is reduced to 1 ft. per sec. by closing the hydrant then the pressure rise will be greater if the closure takes one second than if two seconds are employed, in fact if the time taken to close the hydrant is long enough, there will be no appreciable pressure rise at all. Broadly speaking there is more danger to piping normally operating at low pressures than to those ordinarily under high pressure. Oddly enough, too, there may be quite as high pressure rise in short pipes as in long ones undergoing the same velocity changes. The only reason that there are rather more failures in the long pipes is that it is easier in these cases to have the conditions that produce the maximum pressure rise. As an instance of the severity of this effect in short pipes a case observed by the author showed a pressure rise of 90 ft. in a pipe 337 ft. long, carrying water at 3.9 ft. per sec. and in which the static pressure was only 54 ft. so that water hammer put the pressure up to nearly three times normal. This condition was caused by opening the switch on the motor without closing the pump discharge valve so that return flow was stopped by the check valve.

Water Is Compressible

So much has been said about water being incompressible that many people accept the statement as a literal fact whereas water is really an elastic fluid and will change its volume according to the pressure put on it. For example, if a 24 in. pipe 4000 ft. long is full of water at atmospheric pressure and it is desired to put on it a test pressure of 100 lb. per sq. in. then, if the pipe and fittings are perfectly tight and the material in the pipe itself does not stretch, it will be necessary to pump in approximately four cubic feet of water before this pressure will be reached. Obviously this shows that the water is compressible but only to such a slight extent that the change in volume may be neglected in the great majority of hydraulic problems. It is only because of this elasticity that water pipes do not burst every time a relatively large valve in them is closed. This elastic property is responsible for the interesting fact that when a valve is quickly closed the pressure rise is noticed at once on a gage on the pipe near the valve but it takes an appreciable time (about one second) before any change is noticed on a gage 4000 ft. up the pipe, the "pressure wave," as it is called, travelling up the pipe at a rate varying from 2500 to 4200 ft. per sec., depending on the size and thickness of the pipe and the material of which it is made.

The Pressure Wave

Limitations of space and the intricacy of the problems prevent a full discussion of the matter here although those wishing it might consult the author's book "Hydraulics for Engineers" or his paper "Water Hammer in Pipes, including those supplied by Centrifugal Pumps" which appeared in the Proceedings of the Institution of Mechanical Engineers (England) on page 245 of Vol. 136 (1937). The latter paper gives a full analysis of the subject and the periodical is in most large technical libraries. In ordinary water works distribution piping the velocity with which the pressure wave travels along the pipe, designated by a ft. per sec., for class C cast iron pipe is given in approximate figures in the following table:

Diameter of Pipe, in.	Velocity *a*-*ft.* per sec.
6	4200
12	4050
16	3960
20	3910
24	3880
30	3830
36	3800

As an example suppose there is a 12 in., Class C, cast iron pipe 8100 ft. long carrying water from a reservoir to some point below it where there is an open hydrant drawing 1200 U. S. gal. per min., corresponding to a velocity of 3.4 ft. per sec. in the pipe.

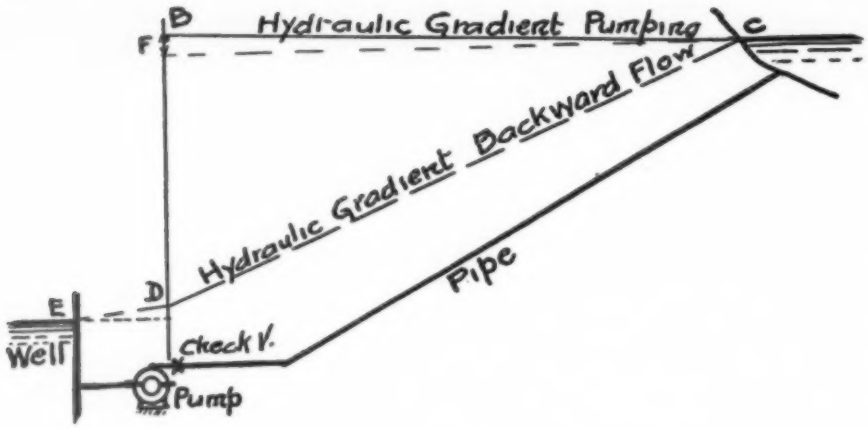

Fig. 52. Diagram of One Condition for Water Hammer.

Suppose, now, that the hydrant is quickly closed, then a pressure rise will be at once created in the pipe above the hydrant and this pressure rise will take 8100/4050 or 2 sec. to travel the full length of the pipe to the reservoir end, so that a gage on the pipe at the latter end would show no change in pressure for 2 sec. after the flow ceased at the hydrant. Both theory and experiment show that this pressure "wave" travels up to the reservoir, and when it reaches there it is "reflected" and travels down along the pipe till it comes again to the hydrant or valve, so that after the hydrant is closed a period of 4 sec. elapses before the returning wave reaches the valve or hydrant.

It is hardly necessary to labor the water works operator with these points for he knows that when a check valve closes against return flow there is an immediate rise in pressure at the valve, and for a brief interval the gage remains fairly steady, but shortly afterwards there is again rapid movement of the gage hand when the wave has again reached the valve.

The study of this action is fascinating but very difficult and it is only possible to mention certain features of it. The pressure rise depends on how quickly the flow is checked and the theory shows that if the closure of the outlet is completed before the return wave reaches it the maximum pressure will be produced; that is, in the case just quoted the maximum pressure will result if the hydrant is closed off in 4 sec. or less, but the pressure rise decreases rapidly as the time of closure is lengthened.

Inasmuch as the pressure wave travels at the rate of approximately 4000 ft. per sec. in cast iron pipe it would make the round trip in a pipe 400 ft. long in one-fifth of a second, a period much too short for the closure of an ordinary valve by hand although a check valve may close in less time than that; whereas in a pipe 40,000 ft. long the return trip would take 20 sec. which is sufficient time to close some valves mechanically. That is the reason why long pipes require special attention, because in them conditions producing maximum water hammer pressures are much more likely to occur than in the shorter pipes, but if the closure is within the period mentioned the pressure rise in the short pipe would be exactly the same as in the long one if the velocity had been the same in each.

Experiments

Our knowledge of this subject was vastly increased by the fine work of Joukouvsky, who conducted experiments in Moscow in 1897, on water hammer in pipes nearly 5000 ft. long, selecting pipes in the water works system for the purpose. He confirmed by experiment what he deduced by theory, that if the closing of a valve was completed before or at the same time as the return wave reached it then the pressure resulting had its maximum value, and the pressure *rise* in feet could be calculated from the formula $\frac{av}{32.2}$ where v was the velocity in the pipe before closure began. Taking the value of a (the wave velocity) as already given for class C cast iron pipe it is evident that for this class of pipe the pressure rise may be about 120 times the velocity which was extinguished in the pipe if the closure was within the time given.

That is to say, if water is passing through a pipe at 3 ft. per sec. and is stopped, within the time limit given, by the closure of a valve or otherwise, there will be a pressure *rise* of 360 ft. at the valve. This rise will be the same whether the pipe is long or short and whether the normal working pressure is high or low, provided always that closure is completed when or before the return wave reaches the valve. (For longer closure times the pressure rise is lower.)

For a pipe designed for normal pressure of 30 ft. head quick valve closure will produce a total head of 30 + 360 or 390 ft., from the above data. This is 13 times the normal design pressure and would certainly be dangerous, whereas if the normal working design pressure was 360 ft. quick valve closure would only double the design pressure. For this reason special care must be taken in connection with low head pipes.

Pumping Lines

The pump discharge line of Fig. 52 illustrates one of the possible dangers from water hammer. When pumping, the hydraulic gradient is along the solid line *BC* sloping downward toward the reservoir. Suppose the power is suddenly cut off, the pump stops almost instantly unless it has a very large fly wheel effect, and the pressure at the pump drops to that due to the suction well, slightly below *D* on the drawing, so that the hydraulic gradient will take the dotted position *CDE* corresponding to backward flow in the piping. This will continue till the

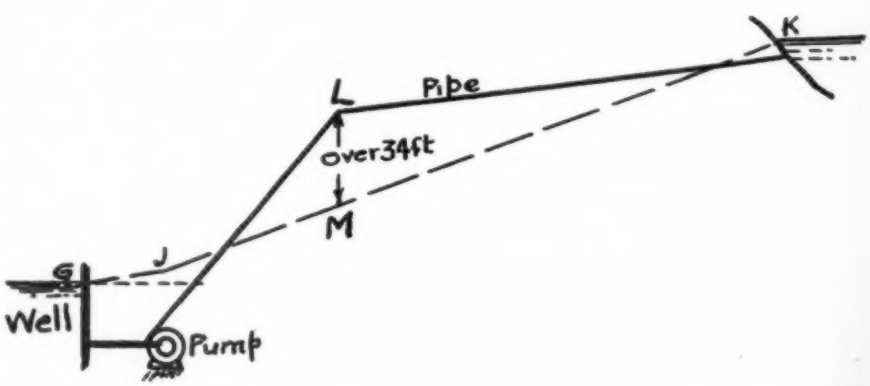

Fig. 53. Diagram of Condition for Backward Flow and Water Hammer.

check valve closes, which often happens with great suddenness resulting in a pressure rise of magnitude given above.

A particularly bad case is that corresponding to the profile of the pipe shown on Fig. 53 where for backward flow the hydraulic gradient tries to fall more than 34 ft. below the profile as at *LM*. Since water cannot flow in tension the column of water in the pipe will break near *L*, as it is known to do in practice, and afterwards the two parts of the column, that starting at the pump and that ending at the reservoir, will reunite with great force, producing dangerously high pressure unless some means is taken of controlling it.

Air Chambers

This whole matter is fraught with so much danger and complexity that it is the work of an expert to figure out what possible pressure may occur in any case, particularly where the line is made of different sizes of pipe and has numerous branches. The

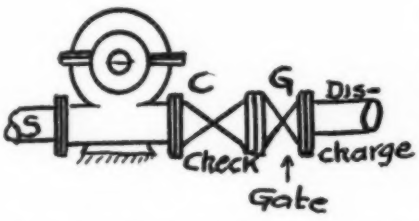

Fig. 54. Check Valves and Gate Valves on Pump Discharge.

author will, therefore, confine himself to the discussion of some methods that have been adopted to decrease the possible pressure rise. Undoubtedly check valves and some mechanically operated stop valves do sometimes close very rapidly and efforts have been made to slow up the water gradually when this does occur.

One of the best known methods in water works practice is the installing of an air chamber, which is often used in connection with pumping stations as well as in private dwellings. In pumping stations, the air chamber is placed near the discharge pipe check valve, and on the reservoir side of it, and the chamber must be at least as large in diameter as the pipe to which it should be connected by a sufficiently large opening. The chamber should be vertical and high enough to absorb the energy in the flowing water, but some form of air compressor must be connected to keep the chamber nearly full of air during normal pumping, and a gage glass should be installed so that the height of water in the chamber may be observed.

The function of the air chamber is, of course, obvious, for after the valve closes water flows up into it against a gradually increasing air pressure, so that the change of velocity is really very slow, and the consequent pressure rise correspondingly small. Its use in domestic plumbing is very common and generally very effective, where loose washers on faucets and lack of packing around the spindles often permit the valves to vibrate rapidly. When they are nearly closed this vibration may cause them to close and partly open alternately thus building up high pressures. Most people are only too familiar with this trouble, which shakes their pipes badly, and as a first precaution should see that there are no loose fittings. Quick closing taps are also often troublesome.

Special Valves

While the air chamber is in common use it is not an efficient way to solve the problem, because compressed air is not a good medium for storing up the energy in water as a result of its velocity. For the larger pipes special forms of valves are available and do their work effectively, being generally preferable to air chambers. To illustrate the matter, a centrifugal pump with suction pipe *S* and the beginning of the discharge pipe is shown on Fig. 54; it has the usual arrangement of valves, including a check valve *C* and a gate valve *G*, the latter usually being wide open during pumping.

In ordinary operation, the engineer usually closes *G* before cutting off the power so that the velocity in the discharge main is low when the pump stops, but if the circuit breaker opens without warning, or the power is suddenly cut off, then unless the pump is a very large one or has a big flywheel effect, it will stop pumping in a second or two, long before the operator could close the valve *G* even if he were close by when the trouble started. The water in the pipe will quickly lose its momentum and start flowing backward through the pump, usually causing it to run backward, and the water quickly attains a high velocity so that when the check closes the velocity to be extinguished may be high. Reversal of rotation of the pump usually does no harm if the pump is made to stand it.

Should the check valve close just as the flow reverses at the pump the plan would be good, but there would still be a pressure rise nearly equal to the working pressure because the check has only been able to stop the end of the water column near it and the rest of the column up to the reservoir still has to be stopped since the water is elastic. Where the pipe is long a good plan is to have the check so controlled that it closes most of the way rapidly, finishing its closure very slowly.

In Article VIII, an example was given to show that with the particular long pipe illustrated, a gate valve could be closed 77 per cent of the way (i.e. be left 23 per cent open) and still leave the pipe discharge 80 per cent of that at full gate. In other words 77 per cent of the valve movement could be made very rapidly without causing any great change in water velocity, and therefore without producing high pressure rise. While these figures illustrate the point they must not be taken as absolute and the exact effect must be worked out in each case separately.

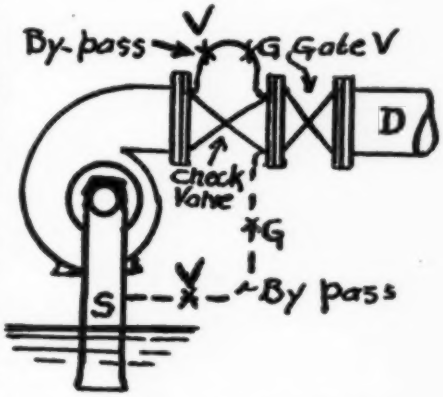

Fig. 55. Check Valve with By-pass on Pump Discharge.

In a long pipe line a regulated check valve could be used in which the first part of the closure could be quick and the last part gradual, but if the valve is a large one the slow part of the movement is hard to control and it may be advisable to use a smaller by-pass around the check, Fig. 55, with a controlled valve *V* in this by-pass. For instance a 36 in. check might have a 6 in. by-pass with controlled valve *V* and a gate valve *G* left wide open normally, and when reversal of flow began the large check valve might be of the quick closing type shutting off a large proportion of the water promptly. The by-pass could then be regulated to close at a slow enough rate to avoid serious pressure rise. If the by-pass is from the discharge side of the check to the suction of the pump, as shown by the dotted line, there will be little tendency for backward rotation of the pump, but, of course, the valve *G* would have to remain closed during pumping and automatically open instantly when the power was cut off. It should not be difficult to design such a valve.

AWWA'S ATLANTIC CITY PROGRAM

Here Presented in Tentative Form Which May Be Modified to Some Extent Between Now and the Convention May 3-7

SECRETARY Jordan and Chairman of the Publication Committee Chas. H. Capen have released the preliminary draft of the Technical Program for the American Water Works Association Convention scheduled for May 3-7 in Atlantic City, N. J.

Distinctive features of the program include the several "Panel Discussions" which are being developed for the forenoon sessions—the intent being to give those attending the meeting an opportunity to bring to the Panel of Experts any questions which they may wish to hear discussed or have answered.

Another new feature will be the two *open sessions* of the Committee on Water Works Practice. One of the sessions will be devoted to a public review of the proposed revision of the association's "Recommended Practice for Repainting Water Storage Tanks." The other session will be devoted to a free "Discussion of Sulfur Jointing Compounds" and a review of experiences of users of these compounds for the benefit of the committee which is considering the merits and reported deficiencies of such compounds.

An examination of the program which follows should convince the reader that the Atlantic City meeting has much to offer waterworks men in all branches of the profession.

TECHNICAL SESSIONS

MONDAY (May 3) MORNING

(A Panel Discussion)

Rates and Regulations for Water Use by Air-Conditioning Equipment:

Elwood L. Bean — Frank C. Amsbary
Ted H. Kain — Lynn B. Mighell
Marsden Smith — R. E. Ebert

Water Conservation and Regulation in New Jersey: Roswell M. Roper

MONDAY (MAY 3) MORNING

(A Panel Discussion)

Water Works Conferences—Schools:

William T. Ingram — H. N. Lendall
Raymond Faust — Edward R. Stapley
A. P. Black

MONDAY (May 3) AFTERNOON

(A Panel Discussion)

Use of Cone and Butterfly Valves in Distribution Systems:

Laurence Goit — Robert Leaf
Lawrence Leedom

Gate Valves—Their Merits and Their Limitations: Donald M. Belcher

Practical Aspects of Water Hammer and Its Correction: S. Logan Kerr

MONDAY (May 3) AFTERNOON

(Water Purification)

Fundamental Principles of Coagulation:
Rolf Eliassen — Martin Wolin

Short Period Flocculation and Clarification Basins:
R. W. Haywood, Jr. — F. H. Weed
H. O. Hartung

Operation and Control of Small Water Treatment Plants: T. R. Lathrop

TUESDAY (May 4) MORNING

(Ground Water Problems)

Facts About a Well—How to Record Them: E. M. Bennison

Ground Water Recharge on Long Island: Arthur H. Johnson

Temperature Effects of Recharge Operations: M. L. Brashears

Changing the Course of Ground Water Flow: Loren H. Blakely

TUESDAY (May 4) MORNING

(Industrial Water Treatment)

Foaming and Carryover in Boiler Operation: R. W. Seniff

Silica Removal with Iron Shavings: Walter B. Leaf

Water Problems in Diesel Locomotive Operation: M. A. Hanson

Removal of Hydrogen Sulphide from Water: S. T. Powell

Treatment of Public Water Supplies for Industrial Uses: R. B. Martin

TUESDAY (May 4) AFTERNOON

Administration of State Water Control Legislation:
Howard Critchlow — George E. Ferguson
George S. Knapp

National Aspects of Ground Water Recharge: E. Nelson Sayre

A Rational Policy in Controlling Nation's Water Resources: Abel Wolman

TUESDAY (May 4) AFTERNOON

(Fire Protection)

New Industrial Fire Hazards:
M. M. Braidech

Water Requirements for Fire Protection:
A. C. Hutson

A Superintendent's View of Fire Protection Requirements:
S. F. Newkirk

WEDNESDAY (May 5) MORNING

Water Works Practice Committee

(An Open Session)

Discussion of Sulfur Jointing Compounds:
Wendell LaDue

John C. Detweiler	W. W. Duecker
Martin Flentje	C. R. Payne
Joseph Schwada	George McKay
Frederick Ohrt	Guy Northrop

An Investigation of Cathodic Tank Protection:
Peter Pallo

WEDNESDAY (May 5) MORNING

(Finance and Accounting)

Porto Rico's Water Supply Developments:
Sergio Cuvevas

Solving Havana's Water Supply Problems:
Manuel Puente Jose Garcia Montes

The Water Works Dollar—Whence Comes It; Where Goes It:
Charles H. Capen

Public Utility Billing and Accounting:
A. Knaff

WEDNESDAY (May 5) AFTERNOON

Dealing With the Public in Obtaining Rate Increases:

Leonard Thompson	Percy A. Shaw
Rennie I. Dodd	W. R. Wise

The Outlook for Municipal Bonds:
Frederick L. Bird

Suburban Main Extensions and Rates for Water Use:

S. T. Anderson	Paul Weir
H. B. Miles	G. E. Arnold
C. M. McCord	W. Compton Wills

W. C. Morse

WEDNESDAY (May 5) AFTERNOON

(Chlorination in Review)

(40 Years of Chlorination in North America)

The First Step—Chicago 1908:
Chas. A. Jennings

Trying to Measure Chlorine Gas:
Martin F. Tiernan

Personalities in Chlorination:
Harry A. Faber

Chlorine as a Water Treatment Material:
Gordon M. Fair

THURSDAY (May 6) MORNING

(General Session)

The Public Relations Program of AWWA—An Appraisal:

The Objectives	Ralph B. Cooney
Dealing with Public Officials	M. B. Cunningham
Selling the People a Project	Kenneth V. Hill
Paid Advertising a Useful Tool	Walter S. Byrne
Promoting Good Publicity	Don O'Reilly
Making Friends of Customers	E. L. Filby
Objectives Reached?	Ralph B. Cooney

THURSDAY (May 6) MORNING

(Water Purification)

The Identification of Nuisance Organisms:

Slime Forming Organisms	F. B. Strandskov
Sulfate Reducing Organisms	R. L. Starkey
Iron Bacteria	George Norcom

Biological Balance in Impounding Reservoirs:
Chas. E. Renn

THURSDAY (May 6) AFTERNOON

(Pumping and Piping)

An Automatic Booster Pumping Station:
Marsden Smith

Pumping Stations for Medium Sized Cities:
Francis S. Friel

Steel Water Pipe Line Appurtenances:
Laurence E. Goit

Steel Pipe Ring Girder Construction:
G. H. Garrett

THURSDAY (May 6) AFTERNOON

(Surface Water Panel Discussion)

The Public Use of Reservoir Lands and Waters—Its Public Relations Aspects:

Gerald Arnold	Eugene F. Dugger
E. T. Anderson	Chas. E. Moore
R. E. Bonyun	Edward H. Hopkins

Making Reservoir Lands Pay Their Way:

Wendell LaDue	Percy A. Shaw
George F. Hughes	John M. Heilman

FRIDAY (May 7) MORNING

Water Works Practice Committee

(An Open Session)

Recommended Practices for Painting Water Tanks

(In the discussion of which all interested tank owners and tank maintenance, repair, and painting firms are being invited to participate.)

DEVELOPMENTS IN WATER CHLORINATION PRACTICE—1947*

By HARRY A. FABER †
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THE CHLORINE INSTITUTE
NEW YORK, N. Y.

THE American Water Works Association made available to the water works industry a clear and reasoned statement with reference to the vital role of chlorination in protecting public health [1]: "Whatever may be said by anyone today against the use of chlorine in drinking water may be nullified by recognition of the simple fact that there are hundreds of thousands of our people today who are alive and healthy because chlorination of drinking water has been recognized by water works men as a necessary element in protection of the quality of the product."

A "Chlorine Manual" [2] was published providing useful facts about chlorine and the proper handling of chlorine containers, recommending measures for employee protection, and supplying data concerning the chemical and physical properties of chlorine. According to the representatives of one chlorine producer [3], the present shortage of chlorine is caused by increased requirements for previous uses, and growing needs for new uses (such as plastics, insecticides, weedicides, etc.). The current shortage is expected to continue for at least two years.

In New York State[4], the value of having emergency chlorinators available has been amply demonstrated. During the past year emergency chlorinators maintained by the N. Y. State Health Department were in use a total of 925 days, or an average of 51 days for each installation. The State points out that the only safe answer to the problem of continuous chlorination is the installation of standby machines so that one will always be available in the event of failure. It is stressed that, if emergency equipment had not been available, the health of water consumers in eighteen communities would have been seriously endangered. At Little Rock, Ark.[5], a portable trailer-mounted chlorinating unit has been designed for sterilization of water mains, and the development by A.W.W.A. of a recommended standardized procedure should do much to extend the practice of main sterilization and place it on a more dependable basis.

The Author

In the field of research, studies at Harvard University [6] are being made with reference to the action of chlorine and chlorine products on bacteria, cysts, and viruses. These are directed toward an understanding of the basic factors which affect chlorination and the possible development of a formula for effective chlorination. Factors now recognized to be of outstanding importance are: the acidity or alkalinity of the water, contact time, and, most important, the *type* of residual chlorine present.

Expansion of Free Residual Chlorination Practice

The present concept of chlorination, in which a distinction is made between two types of treatment (free residual vs. combined residual chlorination) has been reviewed in a paper by Faber [7]. This concept is based on a chapter for the forthcoming A.W.W.A. Manual of Water Quality and Treatment, which has been prepared by a committee of the Association. Definitions are now provided for specific types of chlorination and suitable control methods are available. According to Griffin [8], the break-point process as a method of providing free residual chlorination is being widely adopted. By the end of 1946 this process was reported to be in use in at least 370 water treatment plants, including 40 industrial supplies.

In a report to the Engineering Section of the American Public Health Association, Cox and Committee discuss [9] present trends in water treatment and give special emphasis to the many advantages of free residual chlorination practice. At a meeting of the same association, Faust [10] of the Michigan State Dept. of Health reported that adoption of free residual chlorination in that State had not only improved the quality of the water but served as a safeguard through the distribution system. In Michigan, a population of over 3,000,000 in 45 communities is now supplied with water so treated. Free residual chlorination results in superior and more dependable bactericidal action, improves taste, odor, and color removal, eliminates after-growths in the distribution system, and is reported capable of inactivating the virus of poliomyelitis. The treatment is considered especially successful in small plants where treatment facilities may be inadequate.

The standards and policies established by the Illinois Dept. of Public Health [11], as part of its water supply program mark a forward step in the application of recent laboratory studies to field practice. With the chlorination studies of the U. S. Public Health Service as a basis, and with its own field studies for confirmation, definite disinfection standards are now recommended. Chlorination to provide free available chlorine residuals is preferred.

Chlorination for Disinfection

A summary of the causes of water-borne disease outbreaks, during the eight years 1938 to 1945, has been presented by the U. S. Public Health Service [12].

*A record developed for W. R. La Due, Chairman, Committee on Water Supply, Am. Public Works Ass'n. It is here published as a separate document at the suggestion of Mr. La Due.

†Editorial Associate, *Water & Sewage Works.*

This data demonstrates the importance of chlorination in water purification: 29 outbreaks of disease were the result of inadequate or interrupted chlorination: The outbreaks resulting from chlorination failures affected 13,346 persons, amongst whom there were 208 cases of typhoid fever. Inadequate chlorination of water is rated as the second largest cause of water-borne disease outbreaks, the largest cause being the use of untreated polluted lake water.

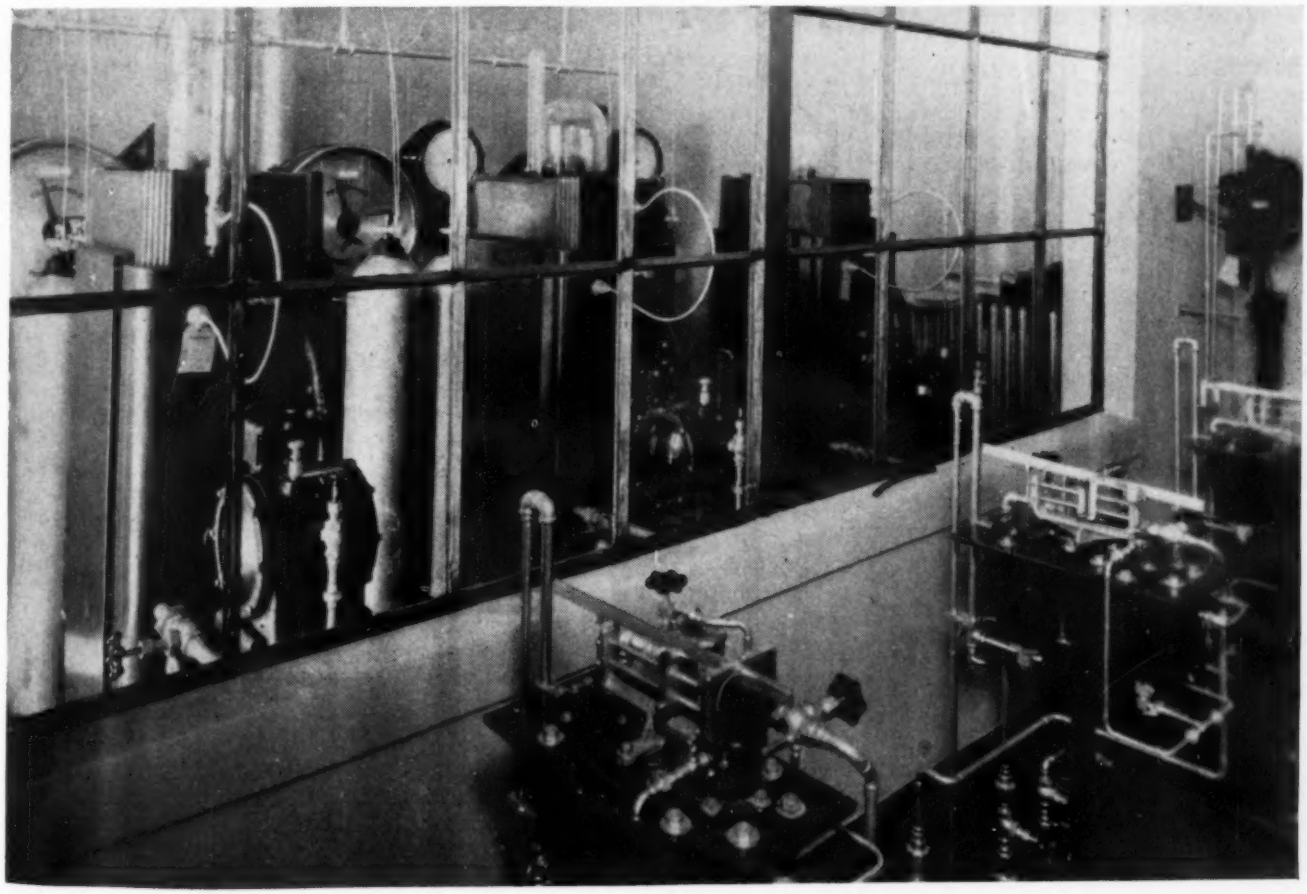
Results have been published by Spencer [13] which show the universal chlorination of water supplies was found by military authorities to constitute the most practical safeguard against water-borne disease. Through strict control over chlorination, no outbreaks of water-borne disease occurred at Army installations in the U. S. during the three-year period 1942 to 1945.

At Baltimore, Hopkins and Edwards [14] have investigated the effect of automatic chlorination of all previously chlorinated water discharging from the open secondary reservoirs to the distribution system. The chlorine application is varied in proportion to the flow of water by means of differential convertors. Bacteriological analyses of delivered water show that a coliform density (MPN) of 0.1 has not been exceeded since 1940. Their study shows that no significant bacterial degradation of water occurs in the distribution system when initial disinfection is adequate and when automatic disinfection of secondary sources is maintained.

Effects of Chlorine on Viruses

Research has been continued by Lensen, Rhian, and Stebbins [15] to determine the ability of chlorine to inactivate polio virus in water. Studies published during 1947 have particular reference to the effect of contact periods, pH values, and types of chlorine residuals. The results show the virus may be inactivated in as little as 10 minutes at pH values between 6.8 and 7.4 when the residuals present contain as little as 0.05 ppm. *free residual* chlorine. When the residual contains only chloramine (combined) chlorine, at least 0.5 ppm. must be present, and the contact time must be about two hours. Additional laboratory studies by Ridenour and Ingols [16] compare the bactericidal effect of chlorine dioxide with that of chlorine under the same conditions. On the basis of ortho-tolidine-arsenite residuals (free available chlorine), the bactericidal properties of chlorine dioxide are reported to be as great as, if not slightly higher than those of chlorine.

A report of U. S. Army medical investigations [17] presents further data on the effectiveness of water treatment methods for inactivation of the virus of infective hepatitis. This disease has been shown to be transmissible by polluted water and was one of the most serious medical problems of the past war. The latest studies show coagulation, settling and filtration of water deliberately contaminated with the virus will not be effective. Treatment of the contaminated water with sufficient chlorine to maintain a total residual chlorine content of 1.1 ppm.



Fully Automatic Chlorination Station at Baltimore, Md.
(Typical of five such stations, automatically chlorinating the outflow from as many reservoirs floating on the distribution system.)

(of which 0.4 ppm. was free available chlorine) did inactivate the hepatitis virus in 30 minutes.

Chlorination for Effecting Chemical Changes

Plant scale tests described by Mathews[18] show that iron and manganese removal can be effected by free residual chlorination at normal pH values and without elaborate treatment facilities. The oxidation of manganese by chlorine is a slow reaction in a settling basin, but seems to be catalytically speeded up when the pre-chlorinated water is filtered through an ordinary rapid sand filter.

Chlorination of raw water to maintain an adequate residual of free available chlorine is credited with rather remarkable results at the Plattsburg, N.Y. water plant[19]. It makes possible coagulation of the raw water with a much reduced dose of alum, or with no alum at all, provides greatly improved disinfection and prolongs filter runs at a lower total cost for chemicals. These results are accompanied by the effective control of tastes and odors. This plant uses fine coal (Anthrafilt) as the filter medium and filter runs average 700 hours.

The use of chlorine for cleaning filter sand at the Hamilton, Ont., filter plant is described by Matheson[20]. After two years of operation, the chlorine demand of the filter sand increased so that increasingly higher prechlorination doses were required. It was demonstrated that nitrifying bacteria were present in the filters and caused the destruction of residual chlorine. These bacteria convert ammonia to nitrites, the nitrites require chlorine for oxidation to nitrates; one pound of nitrite nitrogen requires approximately five pounds of chlorine for this oxidation. It was found that the application of 300 pounds of chlorine to each filter (one-twentieth pound per cubic foot of sand) eliminated these bacteria from the filters. It is recognized that reinfection of the filters is inevitable, but savings in over-all chlorine requirements have already justified the treatment.

Simmons at Wierton, West Va., has found[21] chlorine dioxide treatment to provide the best control of tastes and odors thus far available. Treatment of this heavily polluted Ohio River supply is especially difficult, but the application of chlorine dioxide in pre-treatment (1.0 ppm.) and again after filtration (0.5 ppm.) as a safety measure has been found successful. The reasons for use of chlorine dioxide in pre-treatment are both for better taste and odor control and also to accomplish removal of manganese. The treatment is simple and is said to operate at slightly lower over-all chemical cost.

A survey of results accomplished by treatment with chlorine dioxide in six water plants on the Niagara border is reported by Aston[22]. Phenolic and other contamination can be successfully and economically controlled, as shown by results obtained in treating of these six supplies which are heavily polluted with industrial wastes. In discussing this paper, Faber[23] notes that the compound produced by chlorination or chlorine dioxide treatment determines whether or not a noticeable taste will be produced. It is suggested that chlorine dioxide may react with phenol to produce only trichlorophenol, a compound requiring concentration of 1 part in 1 billion of water to be apparent to taste.

Chlorination Test Methods

Connell has published a simple orthotolidine titration procedure[24] for measuring free available chlorine residuals. An adaptation of this procedure is provided by an "eye dropper kit" which is especially applicable to measurement of high chlorine residuals.

An automatic residual chlorine analyzer is described by Gray and Moses[25]. The equipment consists of four parts operating as a unit: (a) Heating unit maintaining water at 20°C. by thermostatic control; (b) Mixing unit where orthotolidine is mixed with water; (c) Photo-electric color analyzer; (d) Commercial recording potentiometer. This unit compensates automatically for color and turbidity in water, for variations in current, and provides a continuous record.

Reporting on the use of an electrophotometer for determining fluorides in water, Todd[26] calls attention to the fact that free residual chlorine interferes with the routine fluoride determination. His data indicate that 1.0 ppm. free available chlorine will show as the equivalent of 1.0 ppm. fluoride. One drop of 10 per cent sodium arsenite solution will destroy the chlorine but, even when this is done before making the fluoride test, the amount of fluoride determined will still be 0.1 ppm. too high.

References

[1]Anon., "SAFE . . . and you drink it!" A brochure pub. by the Am. Water Works Assn., New York, N.Y., for special distribution to members.

[2]Anon., "Chlorine Manual." Pub. by The Chlorine Institute, Inc., New York, N.Y. (Reproduced in the 1947 Reference and Data Edition of *Water & Sewage Works*—p. 253.)

[3]Anon., "Md.-Del. Water and Sewerage Assn. Goes to Washington." *Water & Sewage Works*, 94, 223 (1947).

[4]Anon., "Why Standby Chlorinators Are Necessary." Public Works, Aug., 37 (1947).

[5]Mayhan, W. A., "Main Sterilization Practice at Little Rock, Ark." Water Works Eng., 100, 1002 (1947).

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[7]Faber, Harry A., "Contemporary Chlorination Practices." Journ. A.W.W.A., 39, 200 (1947).

[8]Griffin, A. E., "Review of the Progress in Break-Point Chlorination." Journ. New En.. Water Works Assn., 61, 145 (1947).

[9]Committee Report, "Water Supply." Amer. Journ. Pub. Health, 37, 555 (1947).

[10]Anon., "Free Residual Chlorination." Eng. News-Record, 137, 448 (1947).

[11]Anon., "Chlorination Standards for Illinois Health Engineers." Water Works Eng., 100, 1371 (1947).

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LIQUID CHLORINE FROM SINGLE UNIT TANK CARS

Proves Safer, More Convenient, More Economical at Louisville, Ky.

By B. E. PAYNE and W. H. LOVEJOY
Chief Engineer. Supt. of Purification
LOUISVILLE WATER CO.*
LOUISVILLE, KY.

TO SATISFY the growing demand for chlorine at the Louisville Water Purification Plant throughout the past thirty-five years, changes in chlorine containers and feeding equipment have been made periodically as fast as these improvements have been developed. The latest change made was in the prechlorination equipment wherein a 1-inch pipe line 1,000 feet in length was installed to carry liquid chlorine from a single unit tank car to the chlorinators. This line was completed and put in service in September, 1947, after which time it was in use continuously for the last three months of 1947.

Authors
Payne Lovejoy

Some of the Details

Some of the details of this installation are shown in the three accompanying photographs and one detail drawing. Fig. 1 shows one of the 16-ton single unit cars of chlorine spotted on the sidetrack which is an extension of our chemical unloading track, from which also lime, soda ash and alum are unloaded from cars by means of an "Airveyor" for our new softening plant. This track connects with and runs parallel to the double track mainline of the Cincinnati Branch of the Louisville and Nashville R.R. A chain link fence 10 ft. high and 75 ft. long with gates at the entering end makes an enclosure large enough to store two 16 or 30-ton chlorine cars within it. The fence gates are kept closed and locked at all times except when switching cars. This is done to insure against vandalism or tampering with the car valves or exposed chlorine pipe connections.

Fig. 2 is a close-up of the valve-dome of the car and shows the method of connecting to the 1-inch pipe which carries the liquid chlorine 1,000 feet to the point of application. In the valve-dome of the car are four valves, two of which supply gaseous chlorine and two supplying liquid. We connect to one of the liquid valves by means of 1-inch extra heavy nipples and ells with threaded joints, and from these to a semi-flexible steel expansion loop. This loop is connected, in turn, by means of Vogt ammonia flanges to the stationary 1-inch pipe line which rises from the ground at a point 8 feet off of track center and is fastened to the vertical steel post seen beside the track. A new development in the form of a flexible armored hose will soon replace this semi-rigid steel loop.

Near the point where the 1-inch chlorine pipe enters the ground adjacent to the car is a valve vault. In this vault is located a 1-inch Vogt No. 3045 ammonia type shut-off valve. This valve is necessary to retain the liquid chlorine in the line while changing cars. From this point the pipe line continues underground in a shallow slab covered concrete channel for a lineal distance of 107 feet in which it rises about 30 feet in elevation above the car level to the top of the reservoir bank. In this channel the pipe is carried on a series of 1x3/8 in. flat steel chairs on 10 in. centers to keep it off the bottom. The channel is drained from the low end at the railroad ditch. Design details are shown in the accompanying sketch—see Fig. 4, lower right.

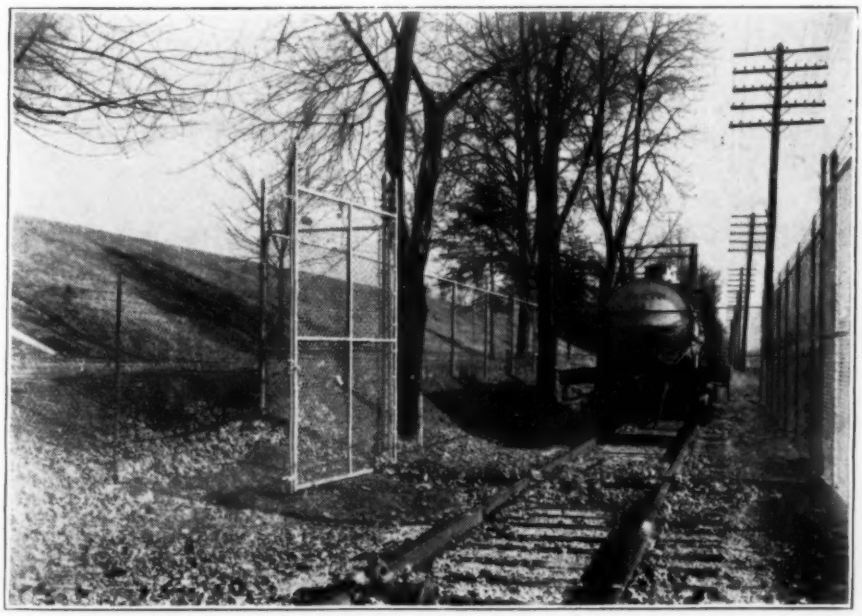


Fig. 1—Single Unit Chlorine Tank Car Berthed in Its Special Enclosure Large Enough for Two Cars
(16 tons of chlorine in one package hooked up with a single connection.)

*A municipally owned and operated system.

Fig. 2—Close-up of Tank Car Connection
(Semi-flexible loop section connects car to 1000 ft. run of 1-inch steel pipe, with welded joints, delivering liquid chlorine.)

At the top of the reservoir bank the conduit ends and the pipe runs under a sidewalk and a massive stone coping, which supports a heavy cast iron ornamental fence that runs around the reservoir. At this point the pipe is brought up with bends and fastened to the inside of the cast iron fence posts with pipe clamps.

Fig. 3 shows how the pipe is supported above ground on the inside of the fence and also shows one of the two large expansion loops supported by angle iron supports. The pipe runs about 800 feet along this fence and extends about 100 feet further into the reservoir gatehouse where the chlorinators are located. No insulation is required on this pipe.

Safety Compression Chamber

Inside the gatehouse the pipe is connected by a tee to a 150 lb. inverted chlorine cylinder mounted in a tight wooden insulated box. Inside this box are two 100 watt lamps to furnish sufficient heat to keep the cylinder full of gaseous chlorine. This is done so that the cylinder serves as a compression-expansion tank to preclude possible development of hydrostatic pressure and to cushion or absorb any undue pressure caused by the hot sun heating the line and expanding the liquid chlorine. This might happen either when the line is shut off while full of liquid or when very little chlorine is being drawn through the chlorinators. From the expansion tank the 1-inch pipe runs directly to the automatically operated and electrically heated evaporators which serves two 2500 lb./day chlorinators.

All pipe used in the chlorine line is extra heavy steel with all joints *welded,* except at the expansion loops where 1-inch Vogt No. 334 ammonia flange connections are used.

When this installation was being designed, we had had no previous experience in piping liquid chlorine and could find very little information from other sources. However, we finally were able to obtain the desired information from our chlorine suppliers, the Diamond Alkali Co. of Painesville, O. When the line was completed and tested with air pressure, no leaks were found in any of the joints. The line was tested and blown out with 100 P.S.I. air pressure. No attempt was made to blow out the line with dried air before the chlorine was finally admitted to it.

One feature of these long lines carrying liquid chlorine is that they can be filled with liquid very quickly, but in case of necessity, they can only be slowly emptied through the chlorinators at usual rates of draft. This line, being 1-inch in diameter and 1,000 feet long, holds 5.45 cu. ft. of liquid, which weighs 91.46 lbs. per cu. ft., or a total of 500 lbs. of liquid chlorine. At a feeding rate through the machines of 3,000 lbs. per 24 hours (which we average) it would require about four hours to exhaust the line.

Increase In Chlorine Use Justifies Change

For several years before this installation was made these prechlorinators were supplied from

Fig. 3—A Stretch of the Exposed Liquid Chlorine Line Along the Reservoir Wall
(One of the two expansion loops in the 800 ft. run appears in the foreground.)

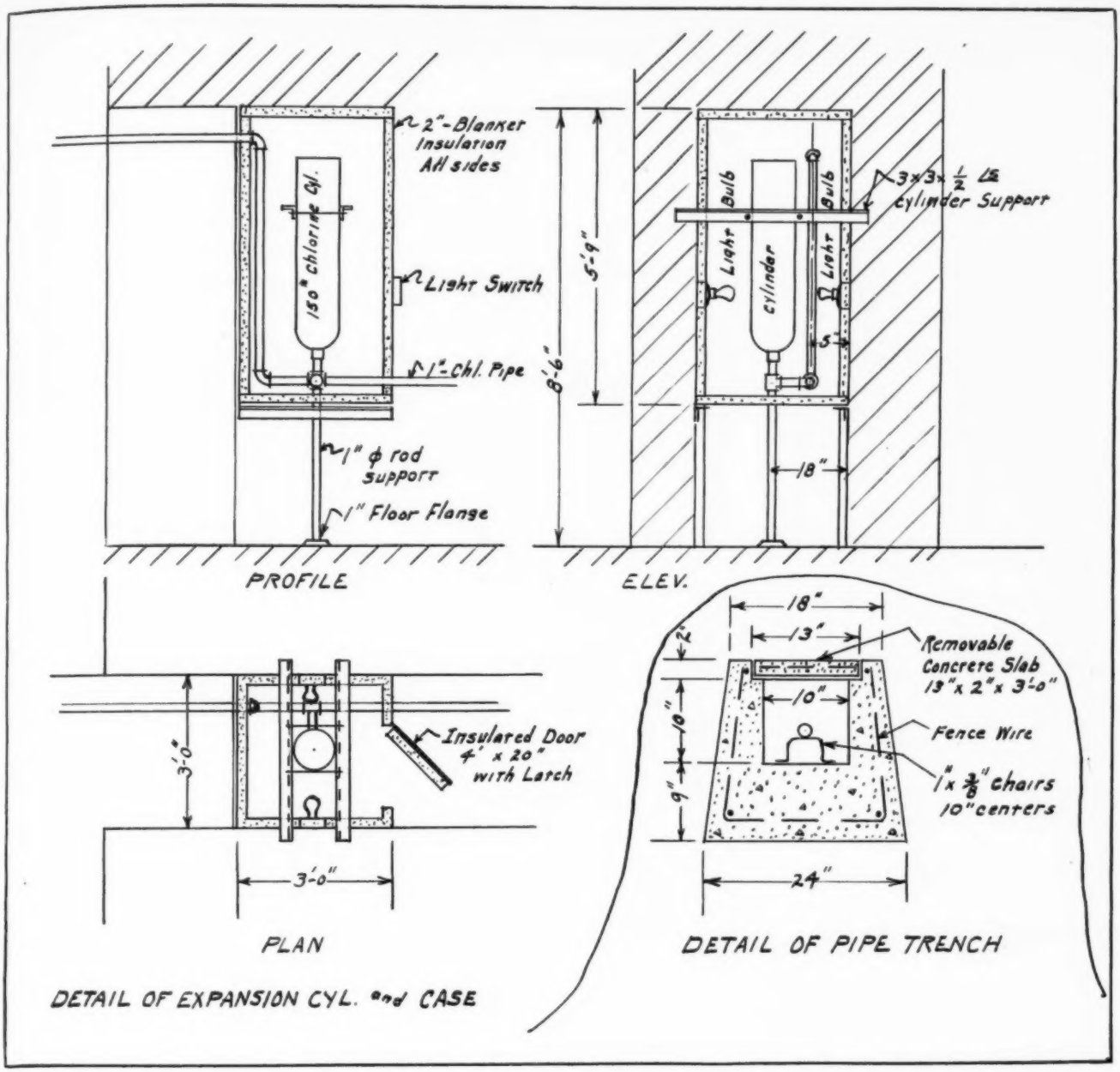


Fig. 4—Details of Expansion Cylinder and Insulated Chamber. Also Details of Pipe Line Channel.

one-ton containers. This experience showed that this method was time consuming and involved much labor. The long truck hauls of many ton containers, one at a time, from railroad spur to point of application a mile away, including loading and unloading and the many connections and disconnections of cylinders to pipe line, would naturally be more expensive (also more hazardous) than hooking up one 16 or 30 ton single unit car.

During the last three months of 1947 we used 200,000 lbs. of chlorine from single unit cars. This is equivalent to 100 one-ton containers. The saving of labor and trucking on these 100 one-ton containers amounts to $440. The saving in cost of the bulk chlorine in tank cars is $6 per ton or $600 for the 100 tons used. The total saving, therefore, for the 100 tons in three months is $1,040 which is quite a neat sum on a total investment for the installation of $3,425.

One-Ton Containers vs. Single Unit Tank Cars

One suggestion from several sources while the installation was being made caused us some concern. This was that it might be rather dangerous to store and use such large quantities of chlorine in the midst of a rather closely built-up residential district as that in which we are located. Our reaction to this thought is that we have for many years stored and used as much chlorine in multi-cylinder units as we are now using in single unit cars. Besides this, we were formerly risking more serious accidents by hauling hundreds of ton containers through the streets on motor trucks.

As a result of our experience with this installation so far our conclusion is that for any plant which uses sufficient chlorine, and has or can provide the spur track required, it would be well to explore the possibility of changing from one-ton containers to single unit cars containing chlorine.

STRAIGHT FROM OUR READERS

–What They Tell Us About–
Leaks in Water Mains

TWENTY-SEVEN water works superintendents in as many cities have answered questions for us on the subject of leaks in bell and spigot joints and 31 men reported on split or broken mains. The sizes of the cities questioned on bell joint leaks varied from one having 5 miles of mains to one with a distribution system of 4,427 miles. In these 27 cities the total length of mains was 10,400 miles.

The average number of bell joint leaks per year on these systems varied from zero to 189. While the largest number of leaks per year occurred on the longest system, the city without leaks had 281 miles of mains.

On the average, there is one leak per year for every 16.3 miles of mains, including the lucky city of Riverside, Calif., where L. W. Grayson reported no leaks in ten years.

The poorest record, or the greatest number of bell joint leaks per mile, was in a little town with 9 miles of mains where one break occurred every two miles each year.

Of the twelve cities with more than 100 miles of mains, the leaks averaged one to every 20 miles, varying from no leaks to one every 3.1 miles. The best record in the eleven cities (having leaks) in this group was less than one leak in the 132 mile system. Next best was one leak in every 73 miles.

How Bell Joint Leaks Are Repaired

Of the 26 cities where leaks occurred, all of them use recaulking as one method of repair. Fourteen cities of the group also use bell joint clamps for repairs, and nine systems use other methods of repair as well.

These other methods of repair include special creeper band clamp; replacement with screw gland pipe; cutting out and putting bell in with a sleeve; burning out joint and rerunning; recaulking and reinforcing with cement; tightening flange bolts; and using hair lead for caulking where the leak is small.

Special Precautions

Special precautions are taken to prevent leaks in at least five particular locations. In answer to the question, the results were as follows:

a—Under heavily travelled highways	— 19 out of 27
b—In the business section	— 14 out of 27
c—Under or near railroad tracks	— 24 out of 27
d—On bridge lines	— 14 out of 27
e—Near new construction	— 14 out of 27

Some of the replies to this question were more specific. In Seneca Falls, N.Y., S. N. Pratt uses casing near or under railroad tracks and Dresser couplings on bridge lines. In Northampton, Penna., J. C. DeGroot uses encasement under railroad tracks and expansion joints on bridge lines.

J. P. Price at Warren, O., uses Class 250 pipe on heavily travelled highways and in business section; sleeves under railroad tracks, Leadite joints on bridge lines; and extra bracing near new construction.

At Raleigh, N. C., E. M. Johnson uses bell joint clamps under highways, railroads, etc.; R. W. Reynolds at Palm Beach, Fla., uses extra cover under highways and in business section; and E. W. Johnson of Minneapolis has pipes under railroads encased in concrete while on bridge lines the pipes are insulated.

Split or Broken Mains

Thirty-one cities answered questions on leaks from split or broken mains. These cities, whose distribution systems ran from 2 to 3914 miles, were not the same cities queried on bell and spigot leaks.

In these 31 cities with a total of 7,160 miles of mains, leaks from split mains occurred, on the average, once to every 21.1 miles. Four cities had no leaks from split mains; one of these systems is 28 miles long, and the others 8, 5, and 3 miles.

Worst conditions were indicated by 35 breaks in 15 miles of pipe, and best condition (besides those having no breaks) was one break for every 184 miles of mains.

Of the eight cities with more than 100 miles of mains, the breaks averaged one per year for each 29.6 miles of pipe.

How Split Mains Are Repaired

Of the 31 cities answering our query, 27 use mechanical split repair sleeves and 15 cut out sections and replace in some instances. In Chicago B. W. Cullen reports that the regular procedure is to cut out and replace the broken section, but mechanical split sleeves are used in approximately 10 per cent of the cases. In the other 207 breaks reported, 114 were repaired with mechanical split sleeves and 93 by replacing with new section, and most of the latter were long splits.

In the cases where the broken section is cut out, nine superintendents report that the new section is joined up with mechanical coupling and 17 report using a solid sleeve for this purpose.

Nineteen of the 27 cities using mechanical split repair sleeves find that the use of these sleeves shortens the repair time, while Ray Walker in San Fernando, Calif., reports having trouble with these sleeves. The other seven men reporting made no comment on this question.

We are indebted to all of the water superintendents who took the time to answer our questionnaires, and we appreciate the yes and no answers just as much as we do the extra information volunteered by those we have quoted above.

Sol Pincus Opens Consulting Office

Sol Pincus, former sanitary engineer with the U. S. Public Health Service, and more recently deputy commissioner and senior sanitary engineer with the New York City Dept. of Health, has announced the opening of his office for the practice of sanitary engineering, public health investigations, and reports, following his retirement from the New York City Dept. of Health.

His office will be located at 11 Park Place, New York 7, N. Y.

OPERATION OF SMALL FILTRATION PLANTS

V. Filters

(The Fifth of a Series of Articles)

by

A. E. CLARK
General Manager
NASHVILLE SUBURBAN UTILITY DISTRICT
NASHVILLE, TENN.

FILTERS constitute what may be called the refining part of the process of a purification plant. Their function is to strain or filter out the fine and lighter particles of floc and bacteria which carry over from the settling basins.

There are two types of filters, slow sand and rapid sand. Slow sand filters operate at a rate of two to ten million gallons per acre per day and the rapid sand 125 million gallons per acre per day.

Slow Sand Filters

Slow sand filters were developed first and were used for clarification only, no attention being given to reduction in bacteria, since it was some years later before it developed that there was a reduction in bacterial content of the water and a consequent reduction in intestinal diseases among persons using filtered water.

The slow sand filter is not adapted to handle waters high in turbidity unless provision is made for clarification by means of settling basins either with or without chemical treatment. The filters themselves are relatively large in area varying from one-third to one acre. Apparatus has been developed for washing the sand in place and is quite satisfactory and saves considerable manual time and labor. Manual labor, at first, was the only method for keeping the sand in good condition. When land costs required for slow sand filters are taken into consideration as well as flexibility of the plant, however, rapid sand filters have proved the more satisfactory method of handling the average surface water, being more adaptable to sudden changes.

The depth of sand in slow sand filters varies from 24 to 40 inches and the effective size from .30 mm. to .46 mm. with a uniformity coefficient from about 1.60 to 2.7. The usual gravel depth is 12 inches. The head of water above the sand should be approximately five feet. The underdrain system is designed to draw water evenly from the whole area of the filter and the rate of flow is generally controlled by the manipulation of gate valves once or twice a day.

The Author

Rapid Sand Filters

Rapid sand filters are designed in units varying in size from the very small filters to 4,000,000-gallons-per day units in the larger plants. Based on a rate of 2 gallons per square foot per minute this would mean that a filter for 50,000 gallons per day would have a sand area of 20 square feet while a 4,000,000 gallon unit would have a sand area of 1,400 square feet.

The underdrain or collecting system is most important because it serves the purpose of collecting the filtered water as well as distributing the wash water. It must be so designed that the water will be drawn evenly from the whole area of the filter and the wash water distributed in the same way. The underdrain system can consist of a series of laterals taking off a header with strainers placed at intervals along the tops of the laterals and header. This method is rarely used now. When the above system is used, the so-called perforated laterals are used in the place of strainer heads. The perforations are on the lower portion of the lateral at about 30 degrees from the vertical and staggered. Strainer heads are only used along the header. In the false bottom type of construction strainer heads are then used and spaced at proper intervals for even distribution of the water. A number of patented filter bottoms have been developed and are very satisfactory. The final objective of all filter bottoms is even distribution of the water and small loss of head.

The gravel is built up over the underdrain system and consists of graded layers varying in size from 3 inch to about 1/16 inch with the largest size on the bottom and placed in layers to the smallest at the top, varying from 12 to 18 inches in depth depending on the type of filter bottom used. The gravel serves two purposes (1) to prevent sand from getting into the underdrains and (2) to help distribute the wash water.

The sand varies in depth from 24 inches to 30 inches with the latter depth the more popular. The effective size varies from 0.33 mm. to 0.50 mm. and the uniformity coefficient from 1.50 to 1.65. The present tendency is toward a larger sand and this has come about through more efficient settling, thus lightening the load on the filters. Crushed anthracite coal is used in the place of sand in a number of places and reports on its use have shown it to be quite satisfactory.

The wash water troughs are usually constructed of concrete or metal, spaced 5 to 7 feet apart so that wash water will not travel a greater distance than 2.5 to 3.5 feet. The freeboard is usually 30 inches.

Five valves are required for each unit, influent, effluent, wash water, drain, and filter to waste or rewash. Loss of head gauge and controller are essential equipment for each unit and more recently sand expansion gauges are being installed. The gauges are either indicating or indicating and recording. In the smaller plants the valves are usually hand operated while in the larger plants they are hydraulically operated and all operations of control are handled from a control table in front of each filter.

Wash water is supplied by gravity or pumping and should be sufficient to give the sand expansion required for proper washing. Filtered water from the filters flows to the clear well which should be large enough to care for fluctuations in consumption and should be covered.

Operation

The operation of filters follows more or less a routine pattern. The maximum loss of head is determined and this will govern the time of wash-

ing. Checks of the loss of head on the filters are made at regular intervals and when it reaches the predetermined figure the filter or filters are washed. If allowed to operate too long after reaching the maximum loss of head, a negative head may be built up which, if allowed to continue can cause trouble.

The washing of filters should be done carefully and operators should be thoroughly trained in this procedure. Considerable damage can be done if care is not exercised when admitting the wash water. The wash water rate should be brought up to the maximum slowly and when there is entrained air in the sand and gravel most of it should be allowed to work out before applying the wash water which should be done slowly. The wash water rate is roughly 15 gallons per square foot per minute and varies according to local conditions, but in general a 50 per cent expansion of the sand should be obtained. The quantity of wash water required to give this expansion varies with the season, in other words, varies with the temperature. There may be times when a greater or lesser expansion is required and this must be determined by the operator.

Washing of a filter should be continued until the wash water is clear, and in connection with the accepted method of washing filters, the development of surface wash has been a big advance in keeping the sand in a clean condition. Again depending on local conditions, it is found that some waters are more prone to form mud balls than others. These are usually small, but sometimes are greater than ¼ in. in diameter, are troublesome and if not eliminated may prove quite costly. The use of surface wash of the proper type will usually keep the sand free of these mud balls and practically all plant designs now include provision for surface wash. If surface wash is not available then other means must be provided to eliminate them or keep them to a minimum.

The use of lime fed into the influent line from the settling basins to the filters will solve this problem. The dosage required will vary, but will probably be about 0.5 gpg. Another method which can be used, say once each month, is to hand-wash the sand using a fan tail nozzle and water pressure at about 75 psi. This method has proved effective in keeping the small mud balls at a minimum. Other treatment methods which are satisfactory are sulfur dioxide, chlorine, and caustic. These, however, are temporary measures.

A practice should be made of checking the sand at regular intervals after washing. Another practice which is helpful in checking for hard spots which indicate a partially clogged underdrain is to use a pole while the filter is being washed. It should go to the gravel easily, but if there is a portion of the underdrain clogged, then the sand above it will not rise, and this condition will be readily detected by the pole.

In some cases, pressure filters are used. Their construction is similar to the rapid sand filter, but in place of operating by gravity they work under pressure. They have the disadvantage of not being easily inspected and unless the water to be filtered is relatively clear, their effectiveness is low.

Maintenance and Control

When hydraulically operated valves are used, keep the stuffing boxes properly tightened especially if oil is used for operation. Keep all valves in good operating condition and keep all leaks at a minimum. If trouble is experienced with a valve, repair it immediately.

Check the gauges regularly and if not operating or recording correctly it should be fixed immediately since it is difficult to get dependable results without the loss of head and rate of flow gauges.

Use of the Baylis turbidimeter will detect small quantities of turbidity passing through the sand, which might indicate trouble in the sand bed itself or improper coagulation. A test for alum is given in "Standard Methods" and this will indicate the effectiveness of the filters in removing all the floc.

Sand coating sometimes occurs from manganese, which gives the sand a slick appearance and a color about as black as coal. This condition has been found, among others, where the raw water supply contained the washings from phosphate mines.

Proper operation and maintenance of the filters is a most important part of an operator's job. Maintenance should not be a strictly routine procedure of only washing. Good operation calls for checking sand and gauges and determining the cause if trouble starts to develop. Causes of trouble should be corrected immediately. Such action on the part of an operator will save not only trouble but time and money.

FROM METER READER TO COMMISSIONER

By TOM AMISS*

On January 10, 1924, a bright and good looking lad entered the employ of the Department of Water and Sewerage of Shreveport, La., as a meter reader.

Because of his courage, active interest in the work assigned him, and the manner in which he went about his work, he was rewarded with an advancement at the first opening. This opportunity presented itself when the young man, Joseph C. Pratt, was given a chance to prove his worth in our Engineering Department, which is charged with keeping records of mains laid in the water and sewer system, in addition to designing, estimating and general engineering activities.

When Jo Pratt left the employ of the city in April, 1943, to enter the Navy as a volunteer at forty years of age, he was in charge of the Engineering Department. Completing his tour of duty in the Pacific theatre, he received his discharge in October, 1944, and returned to Shreveport. Encouraged by the experience he acquired in the Sea Bees during the war, plus his long time service in the Department and encouraged by his friends, he offered his services to the city as Commissioner of Public Utilities, subject to the action of the voters of Shreveport. He was elected, receiving a heavy majority over three other contestants, and took office in November, 1946, as executive head of the Department of Public Utilities of the City of Shreveport, thus becoming my superior officer

He lost no time in assisting me in ironing out the inefficiencies existing in the Department and promptly approved a $2,000,000 improvement plan for our water and sewer system, which plan was badly needed at this time.

I am happy to now be serving under one of my boys who made good. In fact I am very proud of our new boss who started at the bottom, and all indications point to a very successful four year term.

*Excerpts from a letter from Thos. L. Amiss, Supt. of Water & Sewerage, Shreveport, La., and the oldest known continuous subscriber to *Water & Sewage Works*.

MILWAUKEE UNCOVERS OLD WOOD PIPES

By JOHN E. HUBEL
MILWAUKEE, WISC.

WHEN the Water Dept. of the city of Milwaukee was laying some new cast iron water mains on Wisconsin Ave. last year, the workmen uncovered some old wooden water pipes that predated the city water system.

According to J. P. Schwada, City Engineer, the original distribution system of Milwaukee was made of cast iron pipe and constructed in 1872 when Milwaukee contained a population of 100,000 persons. Previous to that time citizens obtained their water from numerous springs and wells, or from the river water, and these water supplies apparently were delivered in the wood pipes which were found on the street then called Spring Street. The city itself never used any wood pipe for its lines and these wood pipes probably are old private supplies. There are no available records on the various wood pipes laid, but it is assumed that they were laid sometime prior to 1882 and probably are at least 75 years old if not older.

Old Pipes of Tamarack

All the pipes found were of the same size, 6 in. approximately outside diameter with a 2 in. diameter hole in the center. The pipe was tamarack wood chosen probably because of its lasting qualities, its cheapness, and its obtainability in that area. The bored center was 2 in. in diameter and apparently had been bored by hand,

Section of Tamarack Pipe Dug up in Milwaukee

using a ship's augur. Lengths of pipe are approximately 6 ft. No doubt in drilling the pipe advantage was taken of the center rot very common with tamarack as the drilling seemed to follow the grain very closely.

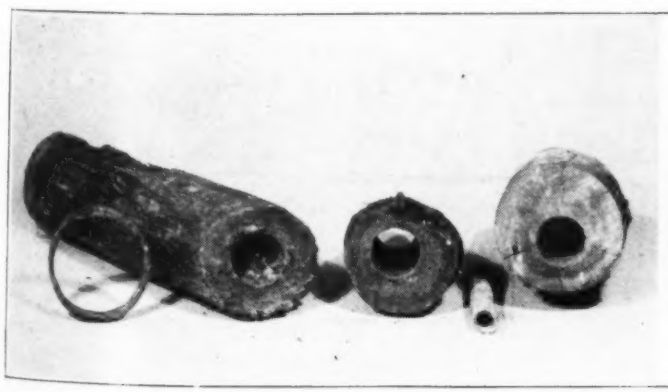
The use of best quality hand made wrought iron in the making of joints plus the lasting quality of tamarack wood probably accounts for the present good condition of the specimen. No doubt the local foundry made the special castings and forgings. The spigot end of each pipe was tapered to a minimum thickness of ¼ in. The bell end was reamed out to form a cone so that the overlap on the spigot was approximately 5 in. The bells were reinforced with iron rings and had a cross section of 1 in. by 1¼ in. and a minimum diameter of 4¾ in. The band ring was made with a slight taper to permit driving to a tight fit over the bell. These rings prevented splitting when the spigot was driven into the bell. The tightness of the joints depended on the accuracy of the workmanship in shaping the pipe and the swelling of the wood caused by the water.

Lead Connection

One connection to the wooden main was found. This was a one-inch diameter lead pipe which had a wall thickness of slightly over 1/16 in. The connection to the main was made by drilling a hole having the diameter of the outside of the lead pipe; a wood plug having a hole through its center was driven into the lead pipe to make a tight fit with the wooden main.

The pressure of this water system which apparently existed for some 30 years was undoubtedly very low. The mains were laid with a five to six ft. cover.

Mr. Schwada believes that these pipes supplied water from springs located where the present North Western Mutual Life Insurance Building now stands. Some two miles distant once stood a hotel which advertised that it was the only hotel with running spring water for its guests. Undoubtedly the water came through the tamarack pipe.



Piece of Wood Pipe, Lead Connection, and Iron Band

Bell and Spigot Joint and Lead Connection

N.J. SECTION WINTER LUNCHEON AT RED BANK, N.J.

Recreational Use of Watersheds Discussed

ON a wintry Feb. 11, eighty-five members and guests of the New Jersey Section of A.W.W.A. gathered for lunch at the Molly Pitcher Hotel in Red Bank, N.J., on the Shrewsbury River. Following lunch, an afternoon program was devoted to papers and discussions on Recreational Uses of Watersheds. The afternoon session was presided over by **Richard E. Bonyun,** Gen. Supt., Passaic Valley Water Comm., Paterson, N.J., and the lunch by Section Chairman **Ed. D. Sheehan,** Supt. Water Dept., Camden, N.J.

Mr. Bonyun introduced the session by quoting from comments on the subject made at a similar symposium in 1940 after which the first paper was presented on Picnic Areas on Watersheds by **Thomas Byrne,** supervisor of the Newark Watershed. On this watershed of 40,000 acres of which 90 per cent is municipally owned, there are still 1700 persons living on private lands.

Although permits for picnicking are not granted, there are three picnic areas where the public may picnic without permits. Hunting and fishing are prohibited officially, but private dwellers are allowed to hunt without permission; a winking at rules which pays off in good will, help in fighting forest fires and reporting of general conditions of the area.

Warren W. Currens, Supt. of Filtration, Passaic Valley Water Com., Little Falls, N.J., also spoke on the subject of picnic grounds, saying that they depended on the filter plant to protect the water supply but did try to prevent the use of the river by bathers and boaters.

Bathing Pools

On the subject of Bathing Pools, **M. Warren Cowles,** Hackensack Water Co., had this to say: Clear streams, small ponds, and lakes are a focusing point for persons desiring to swim, and although reservoirs in the mid-west permit bathing, the Hackensack authorities believe it is improper to locate outdoor pools on main tributary streams or even the smaller feeder streams. On the other hand, outdoor pools may be permitted if the water is filtered and chlorinated, and if facilities are provided for the treatment of water from the scum gutters and the filter backwash.

Mr. Cowles also called attention to the State Sanitary Code of New York which now provides a bacteriological standard for water on bathing beaches. Such a code does not exist in New Jersey.

Parks

The Essex County Park Commission has but a small police force to watch over and control the recreation of some 1,800,000 persons a year. The operation of this park was described by **L. S. Wilsey,** who told of the control exercised over this 2000 acre area where full facilities are provided for camping, hunting, archery, skiing, horseback riding, and bathing.

Real Estate Developments

"Other things being equal the sanitary quality of a water is inversely to the population on the area of runoff," according to **Willard Mallalieu,** San. Engr. Jersey City Bureau of Water. For that reason real estate developments should be restricted to protect water supply. In Wisconsin the sanitary engineer must anticipate pollution from real estate developments, but in New Jersey he has no such responsibility.

Fishing in Reservoirs

"Fish in a reservoir are a real source of attraction to trespassers," said **Dr. Thurlow C. Nelson,** Chairman of the Water Policy and Supply Council of the Department of Conservation Dept. of New Jersey. "You can do as the North Jersey Dist. Water Supply Comm. does"—have the fish netted at regular intervals or issue permits to a limited number of people.

Dr. Nelson described how California appoints deputy game commissioners at $1 a year to help watch for fish and game violations; perhaps this is the solution in other states.

The metropolitan area in New Jersey has the heaviest chemical industry in the country and wastes from these industries make many waters generally unfit for fishing.

L. G. McNamara, of the Division of Fish and Game of New Jersey State Dept. of Conservation also spoke on fishing in reservoirs, and a paper by **David V. Auld,** Superintendent, Water Division, Washington, D.C., on Playgrounds Over Filters and Reservoirs in City Areas was read by **James E. Garratt,** Des. Engr., Div. of Water, Newark.

Discussion

The discussion of these papers was opened by Harry E. Jordan, Exec. Secy. A.W.W.A., New York City, who said that the handling of problems of recreational areas on watersheds was one of the important features of public relations. Regarding playgrounds on reservoirs, Mr. Jordan recalled that in London water reservoirs have tennis courts on top of them, a condition which has no effect on the water supply.

Mr. Jordan said that the automobile has introduced a new factor into the problem of watershed trespassing and that the keeping of water unpolluted by recreational pursuits was no longer a simple one. Jordan suggested that water works executives adopt a plan to cooperate with recreational authorities in which each assumes the responsibility for whatever public use can be made of the reservoir areas.

Discussions of various phases of the topics were also given by a dozen or more of the members present.

SOME PRACTICAL ASPECTS OF CHLORINATION AND COAGULATION*

HENRY T. HOTCHKISS
Consultant

By

VINCENT A. MASCIA
Ass't Sup't

and

WESTCHESTER JT. WATER WORKS,
MAMARONECK, N. Y.

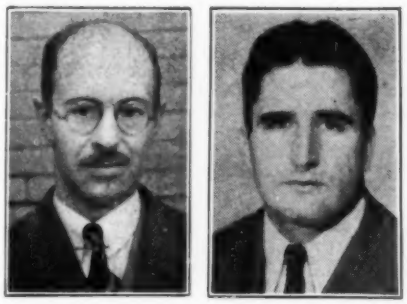
THE greatest public benefit most certainly accrues from investment in sanitation at the primary level—water supply. Economically, it is the wisest form of insurance, which has for some time been emphasized in the New York State Health Dept. slogan, "Public Health Is Purchasable."

In this day it is elemental that water purification plant operators should have at hand equipment which will effectively remove all bacteria and harmful living organisms, or at least be potent enough to kill them "deader than a door-nail" without adversely affecting the potability of the water supply. And yet essential filtration equipment and chlorinators of sufficient capacity are lacking in some works.

In these times when so many public works projects are under consideration, municipal officials should review the conditions at the point of water treatment. They should see to it that the operator gets all those things—all the operating tools—which lead to the production of water having satisfactory aesthetic qualities and free from bacteria. Among these, filters and chlorinating equipment are primary requisites.

The history of water supply has many chapters dealing with the discovery of the possibility of disease transmission by water; the means of preventing water borne epidemics and localized outbreaks; the education of the public to the necessity of essential water supply protection; and the establishment of standards to be met by public and private purveyors of water which is destined for human consumption. Too often these standards have been taken for goals of attainment regardless of any other factors. A rational conclusion today would certainly be: "Kill all the coliform types and cancel out bacteria as a factor."

When epidemologists traced the spread of certain diseases to water supplies, it was found that the bacteriological picture was so important that water works men had to review every aspect from their angle. They had to learn the laboratory technic and the methods of interpreting the results of analyses. Today, someone associated with the operation of each water works has the responsibility of carrying out the routine tests according to the various codes.

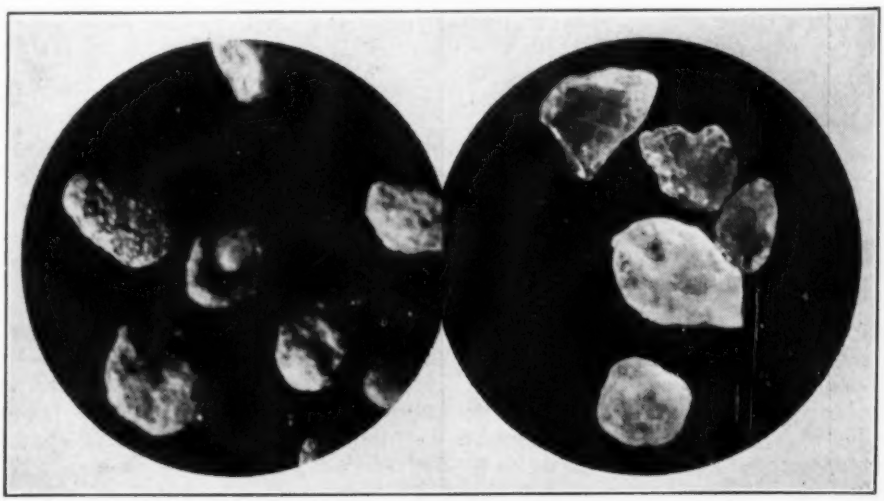


The Authors

Sanitarians became pseudo bacteriologists. Eventually there was evolved a system whereby the potability of millions of gallons of water is certified by testing "thimblefuls." This system of examining water for pathogenic pollution is being relied upon today. Although new media types have been introduced, and efforts made to sharpen the test, i.e., by using 100 ml. samples, the reliance of evidence of gas formation, etc., is still basic. The statistical analysis of thousands of such individual tests has made it possible to classify water sources and plant effluents on the basis of an index of pollution. For the individual test, however, the "pos." or "neg." result is usually unavailable until long after the sampled water has passed beyond control of the operator.

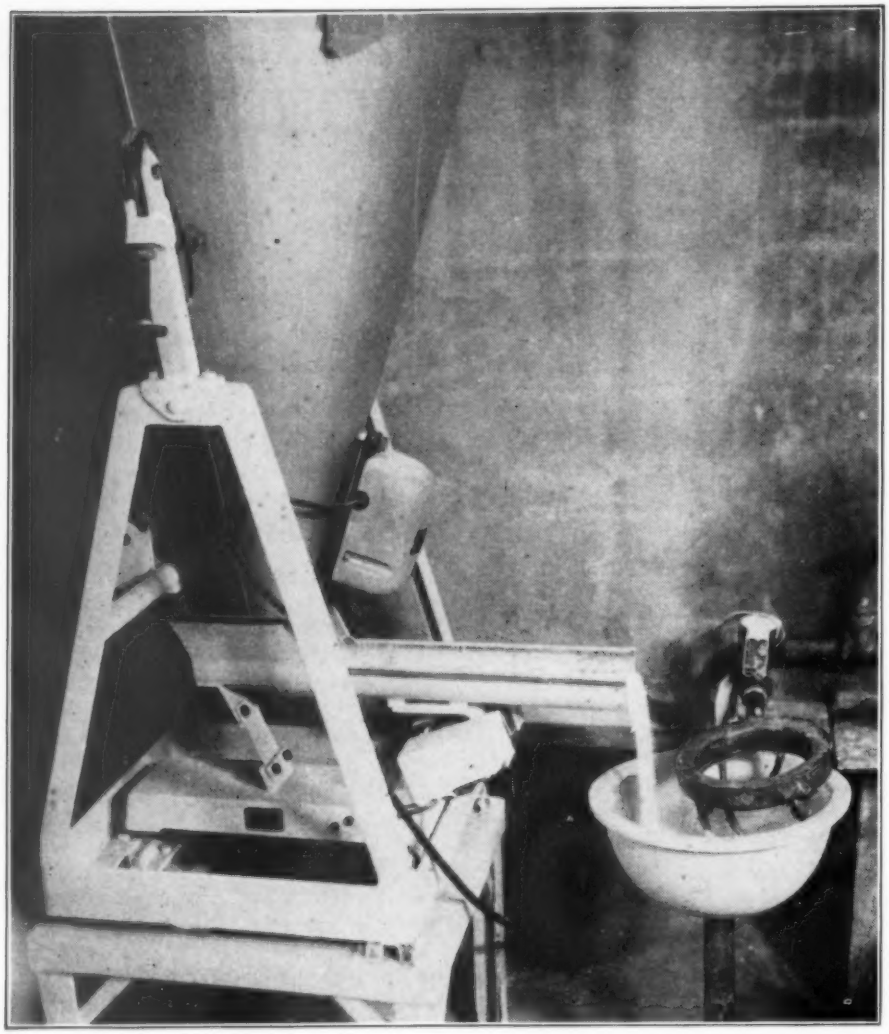
Need for Potability Instrument

The responsibility for bacteriological testing should remain with the health authorities and bacteriologists. The water works superintendent, chemist, or operator should not have this responsibility, but should be provided with an instrument which indicates that the conditions for the elimination of bacteria are being maintained in the treatment. For example, if chlorine is the bactericidal agent, let the experts in public health standards set the conditions, then let the specialists develop an instrument, measuring the oxidation-reduction potential of chlorinated water or some such factor, to "feel" a representative portion of the plant output. The potability-meter thus devised would indicate and record mechanically the evidence of efficient performance. No doubt, until this comes about, operators will have to continue to double as laboratory technicians. There seems no valid reason, however, why treatment facilities should be kept geared to a gas-forming non-confirming stage of treatment.



Specimens of Sand—Coated and Clean
Left: Manganese coated sand (note grain at the center with some of coating removed); Right: clean sharp sand

*The photographs in this article are from the Larchmont, N. Y., filter plant, where Mr. Mascia was formerly chief operator.



Simple Syntron Dry Chemical Feeder Used for pH Adjustment by Either Lime or Soda Ash

(Note clever home-made vortex type of solution pot)

The authors' experiences indicate that chlorination beyond the breakpoint, coupled with a sufficient detention period, activated carbon, sand filtration, and regulated postchloramination with some form of corrosion control, will give a coliform-free product acceptable as a domestic water supply. The elective use of alum during periods of high raw water turbidity, to assist in the mechanical handling of the silt load, has been found practical and economical.

Save on Alum

Under the above operating technic excellent results have been obtained. The practicability of elimination of alum as a routine chemical additive has been particularly gratifying. Substantial dollar savings have been made by using alum only to the extent required to lower *turbidity* and *color* without regard for bacterial reductions. The direct cost of the coagulant is saved. In addition, an equivalent quantity of alkali, i.e., lime or soda ash, for pH adjustment has been saved. Moreover, lengthened filter runs account for real economy in the use of wash water. The resulting conclusion is evident, viz.: Use coagulant only if it is required to control the turbidity or color of the plant effluent. With chlorination now possible at a high level, the days of trapping bacteria in a gelatinous floc are over.

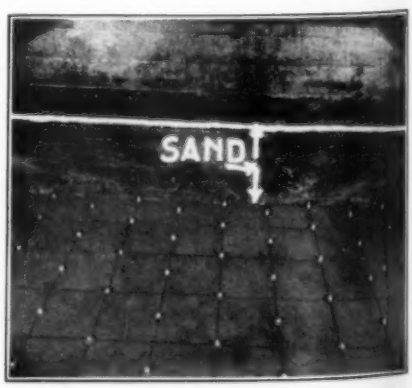
Without the use of added coagulant there still appears to be substantial flocculation in some waters with high pre-chlorination (with attendant oxidation) and sedimentation. Organic complexes of iron and manganese, which may be dispersed as colloids, are oxidized and precipitated. Iron appears to floc under these conditions and manganese most certainly does not pass the filters. In this latter connection it is mentioned here that manganese coated sand is an effective contact bed for the removal of residual manganese existing in solution. This phenomenon has been noted in many plants, especially those situated near coal mining sections of the country.

Where a coagulant must be depended upon for the reduction of color and turbidity, many factors affecting the proper coagulation of the raw water must be considered, such as plant operation and character of the water, viz., temperature, alkalinity, pH, free carbon dioxide, and hardness.

Removing Colloids

The dose of coagulant required will vary from 0.20 grain per gallon to as much as 12 grains. Two filter plants whose water sheds are but two miles apart treat waters which are identical as far as chemical analyses reveal, yet one requires an average annual dose of 3 grains per gallon of alum while the other uses but 0.90 grain. The difference has been ascribed to the manner in which the impurities exist in the raw water and are apportioned between states of solution, suspension, or colloidal dispersion. Among the three, the colloidal matter seems to be the most troublesome.

It is stated that for the most part colloids exist in aqueous dispersions associated with a positive or negative polarity of varying intensity depending upon the environment. There are, in nature, more colloids bearing a negative charge as the common condition, and for some raw waters it appears that a buffering action exists which prevents the complete hydrolysis and flocculation of alum. This may be a type of protective colloidal action. When colloidal particles bearing positive charges are present with negatively charged particles carrying an equal number of negative charges, neutralization occurs and coagulation is made possible. The pH at which this neutralization takes place is referred to as the "isoelectric" point. High residual alumina in filtered water may thus be traced to colloidal interference. Sometimes all the sus-



Porous Plate Filter Bottom

pended solid impurities will be removed by the alum floc, but the colloids will remain.

Colloidal interference may, at times, be overcome by the addition of larger doses of alum, or alum in conjunction with other chemicals such as aluminates or silicates which will shift the pH of the isoelectric point.

Color Removal and Alum Dosage Control

Color in water, being mostly colloidal in character, is often difficult to remove. Usually, the best coagulation is obtained at low pH values. Consequently, more alkali must be used subsequently for corrosion control. It has been noticed on various occasions that when an alkali, such as soda ash, was added after filtration (for corrosion control), color return was observed at the resulting higher pH.

The following data, compiled at one water purification plant, shows the range of alum dose required from June, 1945, to December, 1945.

Month	Turbidity	Color	pH	Alkalinity	Temp.	Hardness	Alum Dose gr./gal.
June	25	20	7.2	35	62° F.	50	3.0
July	30	35	7.1	35	68	43	3.5
August	50	35	6.8	35	70	30	6.5
September	35	35	7.4	35	67	45	8.0
October	20	30	7.4	39	56	65	8.0
November	20	25	7.3	47	43	74	9.0
December	30	30	7.3	40	38	68	10.0

Alum was not used when the required dose was over 3.5 grains per gallon for experience indicated that the floc formed when utilizing the higher doses was generally so fine that proper coagulation was not obtained. Furthermore, under these conditions a large amount of alum would remain in solution. This led to after precipitation in the system.

Alum has a definite utility in water treatment, but in order to secure optimum benefits from its use close laboratory control is essential. The authors have reached the conclusion that for raw waters of moderate turbidity it may be possible to eliminate its use entirely for extended periods of time, at the same time maintaining a plant effluent having highly satisfactory characteristics with respect to turbidity and color. As previously pointed out, with adequate chlorination facilities, it is safe to do this.

Despite the standard procedures which have been developed over the years, it has been found through laboratory and plant studies that modifications of treatment are sometimes very beneficial in terms of operating results. The functions of the various stages of water treatment are so interdependent that it is always desirable to review the component processes and determine their relative importance. The foregoing discussion, with respect to chlorination and coagulation, relates to this kind of weighing of values and it is presented as a guide for others who may wish to carry out their own research with respect to the local facilities for treatment of the raw water available. It may well be that there is naturally present sufficient coagulating substances which only require oxidation treatment, such as superchlorination, to render these substances effective either by oxidation, alteration of the inhibitory colloids, or a combination of both. Only experimentation will answer these and similar questions.

M.I.T. Establishes the Sedgwick Laboratories of Sanitary Science

The Mass. Institute of Technology has established the William Thompson Sedgwick Laboratories of Sanitary Science as its latest addition to the facilities of the Department of Civil and Sanitary Engineering. The new laboratories include facilities for sanitary engineering, sanitary chemistry and research, and sanitary bacteriology and research. They are designed to meet modern educational procedures in the teaching of sanitary engineering and to provide facilities for study of chemical and biochemical reactions which take place in the treatment of water, sewage, and industrial wastes.

At the dedication exercises, Dr. John B. Wilbur, head of the Department of Civil and Sanitary Engineers, presided, while Dr. Samuel C. Prescott, dean of science emeritus and formerly professor of industrial biology, described the work of Professor Sedgwick. Arthur D. Weston, chief engineer of the Mass. Dept. of Public Health, spoke as did Dr. Gordon M. Fair, dean of engineering of the Harvard Graduate School of Engineering.

Prof. William E. Stanley will act as director of the new laboratory and as professor of sanitary engineering. There are four laboratories: sanitary and bacteriological research, under the direction of Dr. Murray P. Horwood; a sanitary chemical laboratory, under the direction of Dr. Clair N. Sawyer; a chemical research laboratory, also under the direction of Dr. Sawyer; and a sanitary engineering laboratory, under the direction of Prof. Ariel A. Thomas.

Ralph Tarbett Passes

On January 23 Ralph E. Tarbett, Sanitary Engineer Director, retired, U. S. Public Health Service, died following a heart attack. Mr. Tarbett was a graduate of the Mass. Inst. of Technology with a B.S. in Sanitary Engineering in 1905. He was associated with Robert Spurr Weston from 1907 to 1912 as a consulting engineer.

In 1913 Mr. Tarbett began his 34 year career with the U. S. Public Health Service when he was appointed as the first sanitary engineer of the Service. Until 1922 he was stationed at Cincinnati, O., then known as the Stream Pollution Investigations' Station.

In 1928, upon establishment of the Sanitation Section within the Public Health Service, Mr. Tarbett was assigned as chief of the section, supervising the environmental sanitation activities

throughout the country with headquarters in Washington, until he was relieved in 1939 for assignment to other special duties chiefly in connection with stream pollution control measures.

During the war and thereafter, Mr. Tarbett was associated with the Office of Civilian Defense and Public Health Service work in Japan, as well as work in Chicago and Cook County, and in Brazil. Mr. Tarbett retired from the Public Health Service about a year ago.

DIGESTION OF SEWAGE SOLIDS

A Review of Established Methods With Comparison and Comment

The First Article of a Series

By LEROY W. Van KLEECK*
Sanitary Engineer
HARTFORD, CONN.

THE years just preceding the second world war saw a succession of methods for the digestion of sewage sludge, which, coupled with the older methods of Imhoff and septic tank treatment, might well be scrutinized for their relative worth. The purpose of this discussion is to compare the operating results which have been observed from these various methods.

Available Methods

There are four treatment units available today for the digestion of sludge:

1. Septic tanks.
2. Imhoff tanks.
3. Unheated separate sludge digesters.
4. Heated separate sludge digesters.
5. Lagoons, as supplemental units.

A definition of sludge digestion adopted by the American Society of Civil Engineers and American Public Health Association states:

"Sludge digestion is the biochemical process by which organic matter in the sludge is gasified, liquefied, mineralized, or converted into more stable organic matter."

*Principal Sanitary Engineer, Conn. State Department of Health.

The Author

Practically speaking, operators of sewage treatment plants consider sludge to be digested when its color is dark brown or black, its odor tarry or gassy, its consistency homogenous, and particularly if it can be dewatered on beds of sand in reasonable periods of time without nuisance. So-called digested sludge varies between plants, particularly in the percentage of remaining volatile matter. This latter constituent is dependent on the initial volatile matter content of the raw sludge, the temperature of digestion, the digestion storage period and other factors. It is important therefore to bear in mind that what may be considered as a satisfactorily digested sludge at one plant might not be at another plant.

General Considerations in Method Selection

A careful consideration of the sludge disposal and digestion facilities for a given plant is emphasized by the realization that as much as one-third of the total plant cost may be expended for sludge handling. Furthermore, not only will a mistake or deficiency in the design of these facilities hinder the digestion of the sludge, but it will affect the performance of the treatment plant and the quality of plant effluent.

In selecting a method of sludge digestion, the following general considerations receive the attention of the designer:

1. The proposed location of the treatment plant. This may determine the degree of digestion required to avoid nuisance to nearby houses due to odor travel. It may also, under poor foundation conditions, determine the type of structure to avoid expensive construction for deep units, such as Imhoff tanks.

2. The size of the treatment plant. The population connected or the flow of sewage or both often dictate whether simple or more elaborate sludge digestion facilities are required.

3. The character of the raw sewage. This raises the possibility that stale raw sludge must be handled or that harmful industrial wastes may be present. Such wastes may form scum, or may retard or more seriously interfere with normal digestion processes.

4. The desirability or practicability of utilizing the sludge gas.

5. The size and type of operating personnel to be provided.

6. The funds which will be available for initial construction and for maintenance of the facilities constructed.

Compactness at Cos Cob, Conn.
Beneath the glass covered sludge drying bed are five septic tanks—note manholes.

SEPTIC TANKS

Except for residential installations, of all the methods for sludge digestion (and sewage sedimentation) none has been more roundly condemned in recent years than the septic tank. To the contrary, the writer believes that not only can such tanks produce effluents comparable with plain sedimentation units, but the sludge deposited in them can be dried and disposed of without serious nuisance, if the plant is reasonably well isolated.

While septic tank plants in Connecticut serving as many as 4000 persons are operating within 200 feet of houses without complaints, large tanks should preferably be removed from houses. If such an isolated plant site is available and the connected population is limited to about 1500 persons, the stage is set for an economical method of primary sewage treatment and sludge disposal. The septic tank has a special field of usefulness for small institutions and factories, in addition to small villages.

Properly built and operated, septic tanks will give good results. The inherent disadvantage of the septic tank, recognized for many years now, is the difficulty of digesting the sludge and scum in contact with fresh settling sewage without disturbing the sedimentation process. *Tailored design and proper operation* of septic tanks will obviate much of this disadvantage.

Design Requirements

Following are the pertinent design requirements:

1. Build from two to four tanks *in parallel.*

2. Provide bottom sludge draw-offs*, if at all possible, otherwise make provisions for pumping with stationary or portable plunger pumps. Riser-type draw-offs should *not* be used.

3. A *scum* draw-off is an added convenience where the necessary head to the sludge drying beds is available. The scum can be floated into a trough with the aid of the sewage and a hand-skimmer, and discharged directly on to the sludge beds or lagoon.

4. The top of the tank must be fully accessible. If sufficient manholes are provided, these are acceptable, but it is more satisfactory to install large plank hatchways or steel doors of the sidewalk type over the inlet and outlet sections. Burying of tanks under earth cover should be avoided. Special treatment of wood and protective coating of steel will lengthen the life of the cover.

5. The size of the tanks should be such as to provide a detention of 6 to 8 hours for average daily flows, in addition to an allowance of at least 3.5 cu. ft. per capita for storage of sludge and scum.

Tank Distributing Inlet

Looking down into distributing manhole serving parallel septic tanks at North Canaan, Conn. Smooth curved section prevents deposits and choking of inlets, proven by long service.

6. The tank bottom should either be hoppered or it may be flat-bottomed, provided it is sloped to a sump located at either the tank's center or inlet end. Slopes of 1:1 are suggested for hoppers of large tanks where excavation will not prove too difficult or expensive.

7. The minimum water depth of large tanks should be 6 feet. Small tanks should have a minimum water depth of 3 feet.

8. When gravity bottom discharge of the tank contents to a sludge drying bed is not possible (as explained under par. 2) and a pump must be used for cleaning of the tank, both a hand-cleaned coarse bar screen and grit chamber should be considered.

9. If a screen and grit chamber is not required, the flow control manholes for distributing the sewage between the parallel tanks should be designed to maintain self-cleansing velocities, otherwise grit and stones or even rags may be deposited and clog the tank inlets.

10. Tanks should be equipped with outlet baffles; small tanks may have submerged pipe outlets. Good inlet distribution should be arranged.

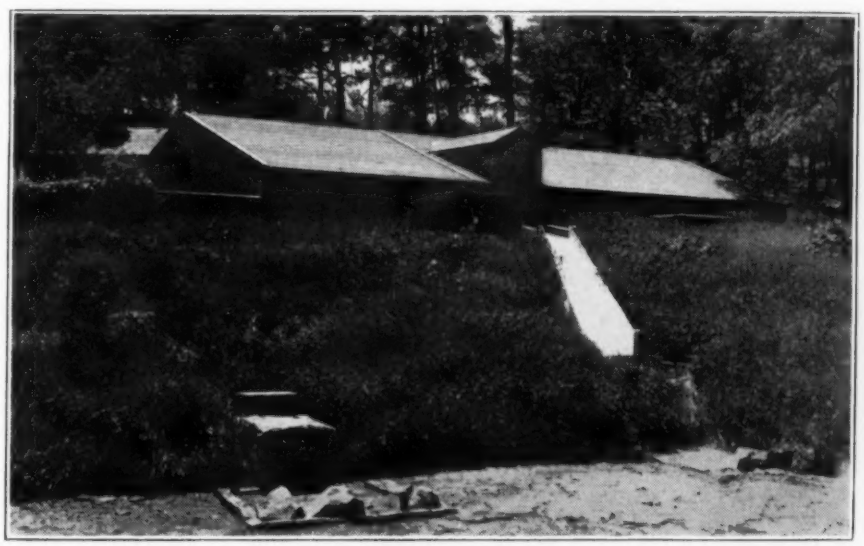
11. Water or sewage effluent under pressure is highly desirable for sizeable installations as an aid in cleaning the tanks.

Operating Requirements

Following are pertinent operating requirements:

1. One or more tanks are operated in parallel for sewage sedimentation. In colder climates it is desirable to start with clean tanks in the late spring to reduce the intensity of rising septic solids when digestion begins in warm weather.

2. After a period of time, usually 3 to 4 months, but never more than 6 months, the tank or tanks in use should be shut off and their contents allowed to digest undisturbed while other parallel units are in service. In small tanks digestion can be promoted by sprinkling several bags of hydrated



Open Top Septic Tank Plant

Housed in and provided with scum trough to sand beds.

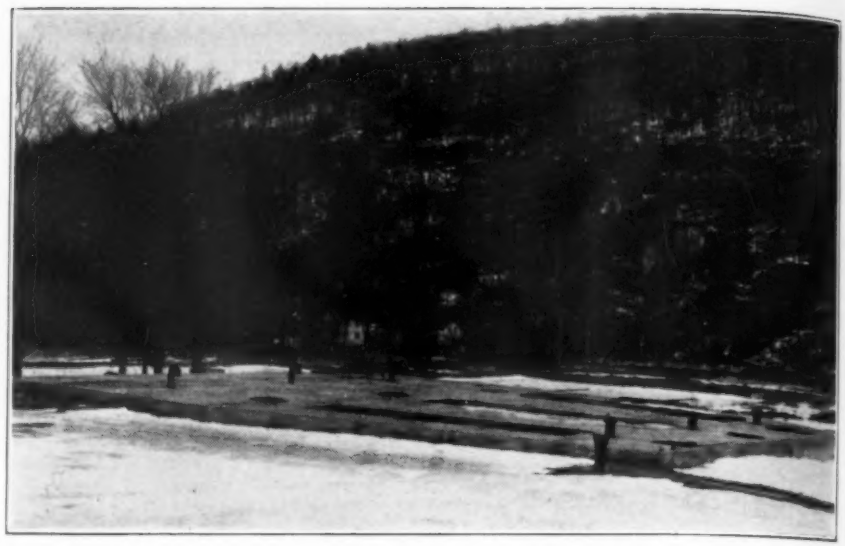
*Such draw-offs should pitch continuously and uniformly downward from the tank's lowest point to the sludge drying bed or lagoon.

lime over the scum and plunging the limed material with wooden plungers. This is done from one to several times during a digestion period extending from 3 to 6 months. In larger installations the tank should be seeded with ripe sludge from a previously digesting unit by means of a recirculating pump. By the process of seeding, a fairly satisfactory sludge is produced, which is admittedly unusual for this type of tank.

In Greenwich, Conn., Doman has carried the process a step further—after seeding he pumps the seeded raw material to a septic tank reserved for sludge and scum digestion. In other words, this septic tank plant is operated as nearly like a separate sludge digestion plant as circumstances permit.

Septic tanks may also be cleaned without advanced digestion of the solids, if the units are isolated from dwellings or if the contents are hauled away for burial or further digestion in lagoons or other treatment units. Drying of semi-raw solids at the plant site, especially of the scum, will be attended by carrying odors, which can be kept at a minimum by drying the material during the cool months of the year and by the use of glass-covered beds or chemical deodorants or both. These aids against nuisance are also effective against fly breeding.

3. When a tank is put back in operation for sewage sedimentation, it should be completely emptied of sludge and scum. If seeding of septic tanks in service is employed, the ensuing digestion interferes with efficient sedimentation. During emptying operations, the relatively clear supernatant liquor between the scum and sludge can be returned at a slow rate to the inlet of the tank or tanks in use without detrimental results to the effluent, thus relieving the sludge beds or saving labor when trucking the scum and sludge away.



A Complete Plant for Small Village

Three septic tanks operated in rotation, sand filters and sludge dewatering beds. These tanks have plank-cover openings and manholes.

4. Following a thorough cleaning, excellent removal of solids and average removal of B.O.D. expected in any form of primary treatment can be expected for several months, provided the tank capacities are adequate. The analyses shown in Table I indicate what may be expected from properly operated septic tanks. All analyses are of samples composited at not more than 15-minute intervals during a daytime sampling period of 6 or more hours.

This sampling represents conditions found with both clean and dirty tanks. The removal of solids compares very favorably with that obtained from the plain settling type of tank.

Conclusions

Years ago, septic tanks for villages and institutions were built too small, buried under earth, and rarely cleaned, with the result that the effluents were inferior and nuisance resulted. When they were cleaned, such an operation was frequently a major undertaking. Today's design and operation can correct the faults of yesterday and permit an economical design for *limited* connected populations at substantial savings in construction and maintenance.

In respect to the extent of operating attention required, no sewage treatment unit can compete with the septic tank. Turn it on, turn it off, secure partial digestion of the contents if necessary, empty it and start again. Sounds simple—doesn't it? And it is! No matter how many push buttons are provided, a mechanical plant requires daily attention and regular maintenance, not to mention the headaches at small installations due to material scarcities and ever ascending replacement costs.

It has been frequently thought that septic tank effluents are stale or septic to an extent that the efficiency of secondary processes, such as sand filtration, or contact beds, will be seriously impaired. Careful watch and the analyses of the effluents from sand filters show that this is not true —the over-all removal of solids and B.O.D. being equal and usually superior to all other types of sewage treatment, not to mention the dependability of such units.

It is suggested that we return to a sensible evaluation of the septic tank for locations where its use is indicated, and leave its competitors, the Imhoff tank and the separate sludge digestion plant to their justified applications.

In the second article of this series the writer will discuss the Imhoff tank and how modern design and operation can do much to overcome its past operating deficiencies and operator headaches.

Table I

RESULTS OF ANALYSES OF SEPTIC TANK INFLUENT AND EFFLUENT SAMPLES

Plant No.	Population Served	Samples Collected over 8 hr. Periods	Sample Of	Av. Susp. Solids, ppm.	Av. Settl. Solids, ml./liter, 2 hrs.	Av. B.O.D. ppm.
1	4000	28	Raw sewage	120	4.8	150
		28	Tank effluent	64	0.9	120
2	1800	28	Raw sewage	240	8.8	320
		28	Tank effluent	100	1.2	210
3	175	11	Raw sewage	355	10.0	470
		11	Tank effluent	105	0.2	350
4	750	12	Raw sewage	100	3.0	140
		12	Tank effluent	20	0.2	75
5	1100	19	Raw sewage	210	8.1	270
		19	Tank effluent	57	0.7	140

N.Y.S.S.W.A. 20TH ANNUAL MEETING IN NEW YORK CITY

THE N. Y. State Sew. Works Assoc. celebrated its 20th annual meeting on January 23, although it was only 19 years old. As a part of the celebration, all charter members and all past presidents were issued special invitations.

Presidents

Incoming
E. C. McKeeman
Supt. Sew. Treat.
Freeport, L.I.

Outgoing
A. G. Martin
Sup. Pub. Wks.
Tn. of Tonawanda

Of 72 charter members still in the organization, 16 were in attendance, and of 17 living past presidents, 13 attended. One past president is deceased. Tables were set aside for these two groups which were introduced at the annual luncheon.

One of the features of the luncheon was the recounting of the history of the beginning and growth of the Association. This story of the N.Y.S.S.W.A. was told by **J. C. Brigham,** long-time assistant secretary-treasurer, and now treasurer.

The principal address of the luncheon was delivered by "Dr. Aleksei Ivanov-Kamnev", who spoke on "American Sewage Works Practice as Reviewed by a Russian Expert". This humorous presentation turned out to be a very clever impersonation by **Alan Johnstone** of Wallace & Tiernan.

Business Session

At the business session the actions of the annual executive committee meeting were announced and the list of new officers was likewise announced. Officers elected for the ensuing year are:

President
Edwin C. McKeeman
Supt. Sew. Treat. Wks.
Freeport, L.I., N.Y.

Vice-President
Paul Bardet
Sr. Sta. Engr. In Charge
26th Ward Sew. Treat. Wks.
New York City

Secretary
Anselmo F. Dappert
Prin. San. Engr.
N.Y. State Dept. of Health
Albany, N.Y.

Treasurer
J. C. Brigham, Asst. Engr.
N.Y. State Dept. of Health
Albany, N.Y.

Member of Bd. of Control, Federation S.W.A. (3 yr. term)
George E. (Doc) Symons
Assoc. Editor, *Water & Sewage Works*
New York City

Awards

Kenneth Allen
C. J. Velz
Hd. Civ. Engr.
Manhattan
College, N.Y.C.

L. V. Carpenter
Henry Rath
Ch. Operator
Tallman's Island
Sew. Tr. Wks., N.Y.C.

Elected to serve on the Executive Committee of the N.Y.S.S.-W.A. for the next three years were John W. Johnson, Sup't. Sewage Treatment, Buffalo, N.Y.; H. M. Gifft, Prof. San. Engineering, Cornell Univ., Ithaca, N.Y.; R. M. McLaughlin, Dir., Div. San. Engr., Westchester Co. Dept. of Health, White Plains, N.Y.

It was announced that the new constitution and by-laws had been approved by the membership, making a change in the method of electing representatives to the executive committee. Hereafter, each section of the N.Y.S.S.W.A. will elect its own representative for a three-year period. The terms will be staggered. There are seven sections, two having been approved at this annual meeting. The other two members will be elected at large.

The executive committee voted to approve the applications of two new sections, the Metropolitan Section, which comprises the five boroughs of New York, and the Lower Hudson Valley Section, which includes Westchester County and other counties on both sides of the Hudson River just above the New York area.

Honors and Awards

Last year the N.Y.S.S.W.A. chose **Wellington Donaldson,** Chief of Bureau of Sewage Disposal Design of N.Y.C., to receive the Kenneth Allen Memorial Award. As Mr. Donaldson could not be in attendance at the annual meeting of the Federation in San Francisco, the award was made at this meeting by **George S. Russell,** President of the Federation. In addition to Mr. Russell's presentation, he talked on the progress of the Federation. There was also present at the luncheon W. H. Wisely, Exec. Sec'y. of the Federation.

The N. Y. S. S. W. A. annually makes a Kenneth Allen Memorial Award for the most meritorious paper of an engineering research nature published by a member during the year. The man chosen to receive the award this year was **Prof. Clarence J. Velz** for his paper on "Factors Influencing Self-Purification of Streams and Their Relations to Pollution Abatement". Prof. Velz is head of the Civil Engineering Dept. of Manhattan College.

Each year the Association also presents a Louis V. Carpenter Award to the operator who pre-

New Members Exec. Com. N.Y.S.S.W.A.

J. W. Johnson
Supt. Sew. Tr.
Buffalo, N.Y.

H. M. Gift
Prof. San. Engr.
Cornell Univ.
Ithaca, N.Y.

(No photo available of R. M. McLaughlin, Dir. Div. of Eng., Westchester Co. Health Dept., White Plains, N.Y.)

sents a paper indicating unusual efforts beyond that necessary for normal operation of a sewage treatment plant. The award for 1946 was voted to **Henry M. Rath,** Ch. operator, Tallman's Island Sew. Tr. Works, N.Y.C., for his paper on "Tallman's Island Plant After Seven Years' Operation".

SYMPOSIUM ON SEWAGE CHLORINATION

(Reported by Harry A. Faber*, Editorial Associate, *Water & Sewage Works)*

Following the business session, the technical program opened on schedule and was presided over by J. M. MacCrea, Mfrs. Agent, Syracuse, and member of the program committee.

In the morning technical session three papers were presented as a symposium on the chlorination of sewage.

*Research Chemist, The Chlorine Institute, Inc., New York City.

Federation Officers

President	Exec. Secy.
Geo. S. Russell	*W. H. Wisely*
St. Louis, Mo.	*Champaign, Ill.*

Health Dept. Regulations

"Survey of State Department of Health Regulations Concerning the Chlorination of Sewage for Disinfection" was the title of a paper presented by Harry A. Faber, Research Chemist, The Chlorine Institute, Inc., New York. Two reasons were given for limiting the survey to disinfection practices: First, because the use of chlorine for disinfection constitutes its most important application in sewage treatment; and, second, because regulations for this use of chlorine can more readily be standardized than can regulations for other applications.

In answer to a questionnaire, detailed replies were received from 45 of the 48 states. Lantern slides were employed to illustrate the data compiled with reference to seven specific questions asked of the chief engineer of each State Department of Sanitary Engineering.

At least 39 states have public health laws or regulations which require that plans for sewage treatment plants be approved by the State Health Department or its agencies. In 20 states these

Twentieth Annual Meeting N.Y.S.S.W.A.—Hotel Pennsylvania, N.Y.C.

plans must, and in 19 should, include chlorination for disinfection under specific conditions. At least 34 states set standards of sewage effluent quality by regulation or recommendation. In 31 states chlorination is required or recmended for effluent disinfection under specific conditions. With reference to the supervision of plant operation, the survey shows 31 states have authority for supervision. Of these, 27 states require the submission of operating reports and require data on chlorination.

Officers

Secretary
A. F. Dappert
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State H'lth Dept.
Albany

Vice President
Paul Bardet
Ch. Operator
26th Ward Tr. Wks.
New York City

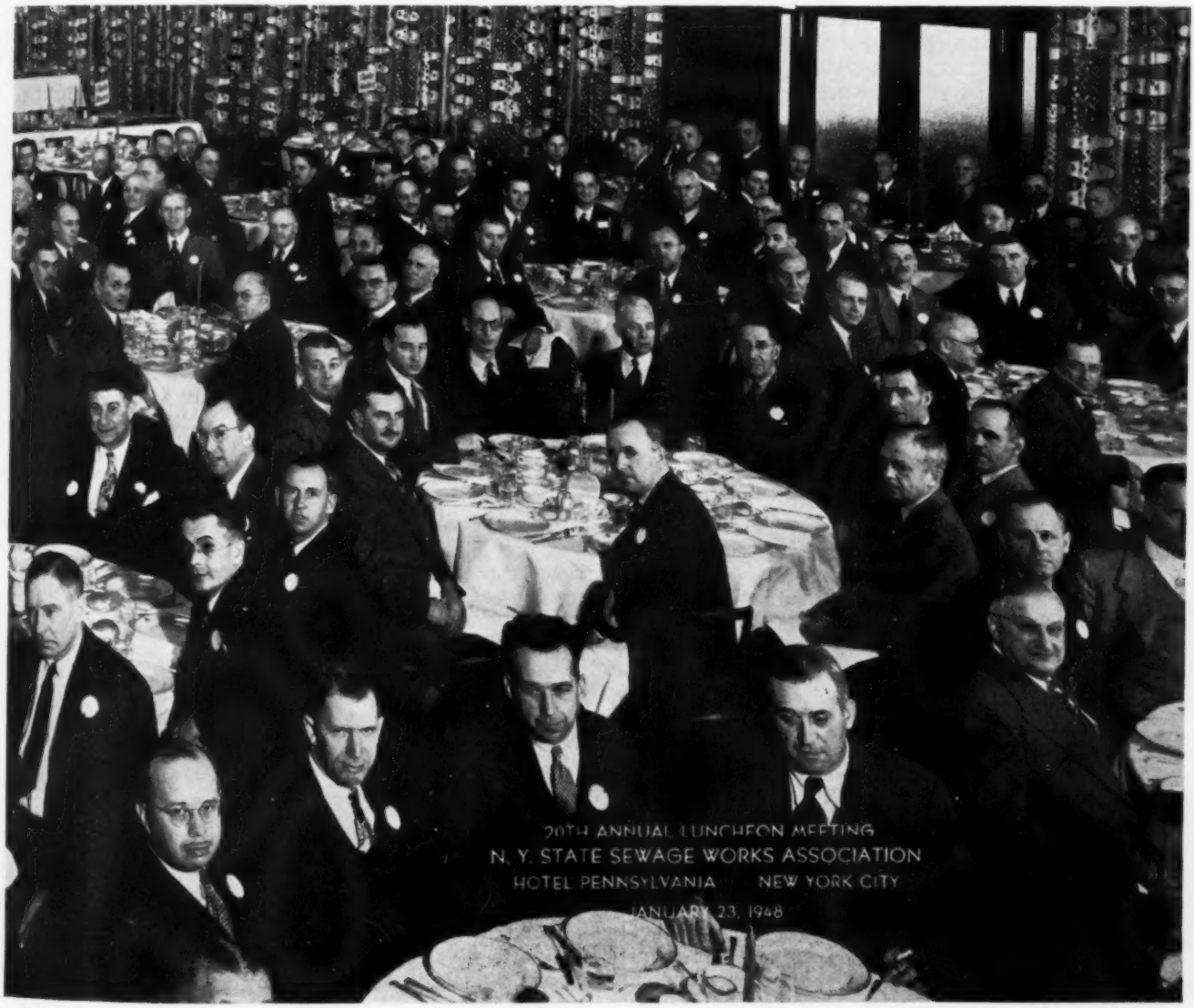
Where sewage chlorination is practiced, the requirements or recommendations are: In 30 states, that chlorine feeding capacity provided shall be related to the volume and type of sewage to be disinfected; in 27 states, that chlorinating equipment be provided in duplicate, and that chlorine containers be weighed on scales; in 26 states, that provision be made to mix chlorine and sewage.

Thirty-seven states set a minimum contact period: In 16 states this is fifteen minutes; in 11 states it is twenty minutes; in 2 states the period is less than fifteen and in 7 states it is more than twenty minutes. At least 37 states require or recommend that residual chlorine exist after a specified contact period: Of 30 states which specify the amount of residual chlorine, 21 states name 0.5 ppm. as the minimum residual.

In summary, it was observed that the majority of states have both authority and policies needed to require chlorination for disinfection of sewage in treatment plants where specific standards of effluent quality must be maintained.

Statistical Evaluation of Chlorination

"A Statistical Approach to the Chlorination of Sewage" was utilized for the first time as a means of evaluating the certainty of disinfection results. **Rolf Eliassen,** Professor of Sanitary Engineering at New York University, presented this paper, with Herman L. Krieger, Research Fellow, and Austin Heller, Research Associate, as co-authors.



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Pointing out the necessity of properly evaluating questions of contact time, residual chlorine, and bacteriological results, Professor Eliassen stressed the value

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New York City

of applying statistical methods in analyzing the results of studies. These methods enable widely varying data to be correlated and the probability of accomplishing selected results to be determined. In the present studies, odds of 79.5 to 1.0 apply; that is, it is established that the results specified will be obtained in about eighty instances for each one instance which gives other results.

Studies reported were limited to a ten minute contact period, though other periods are being investigated. Cotton-filtered domestic sewage, from the Bronx sewers at the University, was employed in all studies. Three variables were investigated in the mixing of chlorine water with sewage: No mixing, slow mixing, and rapid mixing. With each type of mixing, the bactericidal results were evaluated on the basis of percentage chlorine demand satisfaction — applying 0, 40, 100, 140, and 200 per cent of the chlorine demand of the sewage in each instance.

Results of the studies show no significant difference will be found whether rapid mixing or slow mixing is employed after the addition of chlorine to sewage. The results obtained with either rapid or slow mixing, however, are far superior to those obtained when no mixing is employed. The effect of mixing was strikingly shown by the relation exhibited between chlorine residuals and the MPN of coliform bacteria.

In order to obtain an MPN of less than 300 coliform bacteria per 100 ml. in chlorinated sewage (for 50 per cent of the time), about 0.5 ppm. residual chlorine is required (after 10 minutes' contact) when mixing is provided—but about 1.2 ppm. is required when no mixing is provided. If higher bactericidal efficiency is attained, the contrast in residual chlorine requirements is even greater.

The most important disclosure of these studies is that adequate mixing of chlorine solution with sewage is essential for the economical application of chlorine. On the basis of such statistical evaluation, further experiments may be utilized to determine what chlorine residual must be maintained under any existing plant conditions in order to meet a specific standard of bacteriological quality. Another practical value of these and similar studies may be to demonstrate whether long contact period (cost of plant construction) or higher chlorine dosage (operating cost) is the more economical — especially where chlorination is on a five-month basis.

Plant Practice in Chlorination

"Practical Design and Operation in the Chlorination of Sewage," a paper presented by **J. W. Johnson,** Works Superintendent, Buffalo Sewer Authority, Buffalo, N.Y., was the third paper of the symposium. Mr. Johnson reviewed in a comprehensive manner the use of chlorine for disinfection, for control of septicity, for reduction of B.O.D., and for various other purposes. The advantages of prechlorination, to provide maximum contact time, were stressed by the author; and he pointed out that this treatment does not interfere with the digestion of sludge solids.

The location of chlorinating stations will be determined by the use: whether for upsewer treatment, prechlorination, as a part of biological treatment, or for final disinfection. Solution feed equipment is preferable, and that designed for automatic proportional feed is most satisfactory. Even with proportional feed equipment, however, the frequent determination of chlorine demand of the sewage is necessary in order that over- or under-chlorination will not be practiced for long periods. When developed as practical equipment, it is obvious that the most efficient feeding device will be that operating to provide a definite chlorine residual at all times — independent of sewage flow or chlorine demand variations.

Mr. Johnson's paper included detailed discussion of recommended practices such as building design, ventilation, piping, and equipment. Recognition was given to the fact that finally, however, it is the operator who must be responsible for making equipment function and for accomplishing the desired results. As a part of his presentation, Mr. Johnson cited data from results obtained at the Buffalo, N.Y. plant to illustrate differences in bacterial kills during periods of uniform sewage flow and during periods of variable (storm) flow.

Stream Pollution

The afternoon session presided over by Clarence J. Velz, Program Chairman, included two papers on industrial waste and one on activated sludge.

Pollution Abatement Program

"Industrial Pollution Abatement Program for Buffalo, N.Y." was the title of the paper presented by **Dr. George E. Symons,** Assoc. Editor, *Water & Sewage Works,* **George F. Fynn,** Chief Chemist, and **Howard Brown,** Research Chemist, respectively, of the Buffalo Sewer Authority, Buffalo, N. Y. Dr. Symons, former Chief Chemist of the Buffalo Sewer Authority, and now consultant for the Authority, made the presentation with George F. Fynn, his successor as Chief Chemist.

Studies on the industrial pollution of the small stream which is a part of the harbor of Buffalo were begun in 1936 and were discontinued in 1942. In 1946 these studies were resumed under Dr. Symons' direction for the purpose of ascertaining ways and means of reducing the pollution load of

Program

Presided
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Syracuse

Step Aeration
Wilbur Torpey
Civ. Engr.
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New York City

industrial wastes from five major industries discharging into this dredged basin of some 165 million cu. ft.

Early studies showed that prior to July, 1938, the domestic waste from 82,000 persons and industrial waste equivalent to some 162,000 persons were being introduced into that stream. When sewage treatment was inaugurated in Buffalo on July 1, 1938, the domestic waste was removed from the stream and in addition the industrial waste pollution equivalent to some 62,000 persons was abated. Observations indicated that the B.O.D. of the stream had been reduced by 57 per cent and the coliform content by 75 per cent.

The studies inaugurated in 1946 carried on during the five months of May-October showed that in spite of appreciable advances in the treatment of industrial wastes of the five major industries including an oil refinery, heavy chemicals, organic chemical dyes, steel and coke wastes, there had been an increase in the pollution load on the stream. In 1946 this stream was receiving an industrial waste load equivalent to 221,000 persons. Bacterial conditions had, however, improved with the elimination of domestic sewage.

These five industries pumped some 120 mgd. of cooling water from the stream and the first recommendation by the consultant for an abatement program was that a water supply project be constructed to obtain cooling water for these industries direct from Lake Erie. This project, which would cost $5,000,000, could furnish water to the industries at less than ten cents per thousand cu. ft. Estimates of the industry indicate that the consumption of water will be upwards of 140 mgd. by 1950. This volume of water will supply sufficient alkalinity to neutralize more than 60,000 lbs. of acid introduced into the stream daily and dissolved oxygen sufficient to supply approximately one-third of the B.O.D. of the wastes as expected in 1950.

The second major step in this proposed program is the reduction by industry of the present waste load by 50 per cent. The third step is for the Buffalo Sewer Authority to construct such sewers as are necessary to take the waste from a small unsewered manufacturing area not included with the five major industries.

During the past year considerable progress has been made toward implementing the abatement program. Meetings with the industry and with the state boards of health and of conservation have arrived at agreements whereby the desirable condition of the stream was established as being not more than 15 ppm. of B.O.D. at mean dry weather flow. (The mean dry weather flow is approximately 40 cu. ft. a second, although sometimes it drops as low as 20 cu. ft. a second, and the industries under those conditions are pumping the water for use some six or seven times.)

The industries have generally agreed that the proposed project for bringing in cooling water as a dilutant will be beneficial to them and that the cost of such water would be reasonable. Industry will benefit not only by improved stream conditions, but also because the water is cooler, non-corrosive, and contains practically no sediment. The industries also agreed that a reduction of the waste load to 50 per cent of the 1946 figure was desirable and feasible. All industries have begun work on methods to reach this desired condition. Work now being carried on by the industries includes methods for removing toxic wastes; liming of the acid wastes of one industry is now practiced and plans are now being made to take some of these wastes into the city sewers with payment for the chlorine demand of the waste.

Next step in the implementation of the program is development of contractual agreements which are agreeable to the industry and to the City of Buffalo. It is hoped that this will be possible within the next year.

Coke Plant Wastes

One of the industrial wastes in the pollution problem at Buffalo, N.Y. is the by-product of a coke plant. This company has retained **Newell L. Nussbaumer,** Cons. Engr. of Buffalo, who presented a paper on the program for treating the wastes of that plant by **"Pilot Plant for Coke Plant Waste."** It is proposed to experiment at this coke plant for a year with a small trickling filter plant, utilizing recirculation for the treatment of the wastes from the ammonia still. These wastes are high in phenols and B.O.D. Mr. Nussbaumer described the design of the plant and told of the plans for operation. It is expected that the pilot plant will be constructed during the spring of 1948 and the first attempt at operation will be made this coming summer. Plans are to operate the plant during the summer and establish if possible the feasibility of this type of treatment and then to operate under winter conditions. If the pilot plant operation is successful, the coke company will build a full scale plant of this type for treatment of the ammonia still waste.

Programmers All

Sewage Chlorination

H. A. Faber, Res. Chem. Chlor. Inst. N.Y.C.

Rolf Eliassen Prof. San. Eng. N.Y. Univ. N.Y.C.

Luncheon Speakers

Alan Johnstone Dist. Labs. Mgr. W. & T. Brooklyn. (Dr. Alekseï Ivanov-Kamnev, in person)

J. C. Brigham Asst. Engr. State Dept. H'lth Albany (History of N.Y.S.S.W.A.)

Industrial Waste

Geo. F. Fynn Chief Chem. Sewage Authority Buffalo, N.Y.

N. L. Nussbaumer Cons. Engr. Buffalo, N.Y.

If the pilot plant is not successful, the industry will plan to install a phenol recovery plant. Estimates are that the tricklng filter treatment plant will cost less to construct and operate than will a phenol recovery plant, inasmuch as the recovery of phenol is not economically feasible on the basis of by-product recovery.

Step Aeration

According to **Wilbur N. Torpey,** Civ. Eng'r. Dept. of Public Works, N.Y. City, "Step aeration is a modification of the activated sludge process." Torpey was speaking on **"Practical Results of Step Aeration,"** step aeration being a method whereby sewage can be introduced in regulated amounts at multiple points throughout the course of the flow of returned activated sludge through the tanks. This method is used in four N.Y. City plants and Torpey described observations of seven months' operation at the Bowery Bay Plant during 1947.

Step aeration makes possible longer detention of solids in the aerator tanks (i.e., more storage). To fully appreciate the operation of this process, one must consider "sludge age", i.e., the average number of days the sewage solids remain under aeration, from the time the solids enter until they leave the secondary treatment process. (Sludge age in days = wt. susp. solids under aeration ÷ susp. solids entering secondary process daily.)

Studies made during the seven months covered six periods with different methods of feeding and the sludge age varied only from 2.6 to 3.8 days. Relative low S.D.I. values (sludge density index) were obtained in spite of the highly loaded aerators. This was possible because of step aeration. The return sludge varied from 25 to 30 per cent.

In three periods, the average concentration of susp. solids in the aerators was 3100 ppm. In the other three periods it was 3900 ppm. Aerator effluent solids were 1750 and 1610 ppm. respectively. In periods 2, 4, and 6, half the primary effluent received about 95 minutes' contact time with the sludge and half received 35 minutes' contact. (Period six gave best results.)

Air consumption was from 0.62 to 0.68 cu. ft. per gal. The B.O.D. loading was 54 to 84 lb. per 1000 cu. ft. of aerator per day with removals of 85 to 94 per cent. (Normal design is 25 to 30 lb. of B.O.D. per 1000 cu. ft. of aerator per day.)

Air consumption varied from 740 to 490 cu. ft. per lb. of B.O.D. removed. In the latter case the aeration tanks were handling a load 40 per cent greater than in the other five periods, indicating the possible results that can be obtained with step aeration. Change in the mode of adding primary effluent to the various passes of the aerator provided flexibility of operation in accommodating high loads. Two and one half hour detention was available.

Dissolved oxygen in the aerator passes showed sharp rises from about mid-point of the four aerator passes in most of the six periods, but in the last period the rise did not occur until the last ⅛ of the aerators. This was the period when the 40 per cent increased load was in effect. Even at this load the D.O. leaving the aerators was high enough to prevent deterioration of sludge in the final clarifiers. It was decided that the D.O. leaving the aerators should be at least 3.5 ppm., otherwise the B.O.D. of the final effluent went up.

The paper received considerable discussion including comments on "sludge age," relation of oxidation-reduction potential to the results, "washing" the sludge, maintenance of sludge activity by giving it a chance to reactivate itself in the aeration tanks before going to final tank.

The meeting closed with a social hour through the courtesy of The Water & Sewage Works Manufacturers' Assn., and representatives of member companies.

Dr. Black Opens Laboratories

Dr. A. P. Black, Professor of Chemistry at the University of Florida, Gainesville, Fla., and vice-president elect of A.W.W.A., has announced the formal opening of Black Laboratories, Inc., at 968 S. Oak St., Gainesville, Fla. The formal opening occurred on February 25.

Mark Hollis Heads U.S.P.H.S.

Mark D. Hollis has been appointed Assistant Surgeon General of the U. S. Public Health Service of the Federal Security Agency, to replace Admiral J. K. Hoskins who retired after 34 years of activity.

Hollis, a native of Georgia, was with the Chesapeake Bay Pollution Survey in 1934, and later was director of the division of engineering for the North Dakota State Health Department. In February, 1939, Mark Hollis reentered the public health service as an assistant, later was advanced to associate, and later to position of public health engineer when he

was assigned to the Office of Stream Sanitation, Cincinnati, O.

In February 1941 Mr. Hollis was commissioned in the Regular Corps of the Public Health Service. During the war he was assigned to malaria control work in various defense areas, before becoming Officer in Charge of the Communicable Disease Center at Atlanta, Ga. in 1946. In January 1947 Hollis returned to Washington as an executive officer in the Office of Surgeon General and was advanced to the position of Assistant Surgeon General in charge of Sanitary Engineering Activities on the first of this year.

Carnegie Institute Fellowship

Three one-year fellowships awarded by the Matthes Foundation of New York City to South American students carry $1,000 fellowships for graduate study in engineering and science at the Carnegie Institute of Technology for the academic year 1948-49.

These fellowships are open to any Latin American student who has or will have a bachelor's or higher degree in engineering or physical science by next September. Examinations to be held will be under the auspices of the Graduate Record Office of the Carnegie Foundation, and applications must be filed by April 15.

AN OXYGEN CONSUMED TEST FOR SEWAGE

R. S. INGOLS and P. E. MURRAY*
Georgia School of Technology
ATLANTA, GA.

As early as 1893, Wyatt[12] published a procedure for determining the amount of organic pollution in a water by noting the length of time required for the reduction in color of the permanganate ion by the organic matter present in the sample. Many authors[4, 6, 7, 8, 10] since that time have published the findings of their attempts to improve the accuracy and reproduceability of the original oxygen consumed (O.C.) technic that uses permanganate. In America, the chemists[3] have agreed to digest the sample with the permanganate ion by placing the flask with the sample and reagents in a boiling water bath, while in England[10] the standard practice is 4 hours digestion at 27°C.

In 1926, Adeney and Dawson[2] published an acid dichromate method for analyzing water or sewage. In 1927, Abbott[1] published a similar procedure using a lower temperature of digestion. Each of them added a small volume of sulfuric acid to the sample, took the sample to dryness on a water bath, and continued heating to drive off the chlorides. A small volume of a standard dichromate solution was added to the residue and the mixture again evaporated to a very small volume. More sulfuric acid was added and the mixture digested for two hours on a water bath (by Abbott) or at a higher temperature (by Adeney). The excess dichromate was then determined and the difference in titrations between this value and the blank titration value used as the O.C. value.

This determination requires close attention to prevent charring when removing the chlorides and requires at least three hours elapsed time. The results given on pure organic substances are quite low because of a partial loss during the chloride evaporation period. Some comparative results have been published by Klein[10], using Abbott's O.C. procedure, the B.O.D. test, and the English O.C. methods.

The Senior Author

In 1937, Burtle and Buswell[5] published the results of determining the total organic carbon in sewage and industrial wastes by digesting the sample with the dichromate ion in a phosphoric-sulfuric acid mixture. The amount of organic matter was determined by measuring the carbon dioxide evolved during the digestion. The O.C. values, calculated on the basis of the organic carbon, correlated fairly well with the 20 day biochemical oxygen demand (B.O.D.) values as in the case of Abbott[1]. However, a technique for organic carbon which measures the carbon dioxide evolved[5] is time consuming because of the apparatus that must be assembled and taken apart and the amount of attention that must be paid to the digestion. In 1941, Johnson and Halvorson[9] reported an O.C. procedure using the iodate ion instead of the permanganate or dichromate ion for oxidizing the organic matter of polluted samples. Only abstracts of this method have been published, however.

The standard O.C. test[3] may be used in analyzing certain toxic industrial wastes or in giving a rapid approximate sewage strength if the value is multiplied by some factor peculiar to the type of sample. It has been realized for some time that the results of the O.C. test are only slightly affected by the complex nitrogenous organic matter present in a sample. The English[6] have realized this difficulty and have developed an O.C. test for nitrogenous material by using the hypochlorite ion as the oxidizing agent and have continued to use the permanganate ion for determining the carbonaceous matter in the samples. The use of the hypochlorite ion has not been adopted in this country.

According to STANDARD METHODS FOR THE ANALYSIS OF WATER AND SEWAGE[3], the results of the O.C. test are affected by the amount of carbonaceous matter in the sample. As shown in Table II, however, a 200 ppm. starch solution gives an O.C. value only one-half that of a 200 ppm. dextrose solution. It would appear that the conditions of the O.C. test do not favor the hydrolysis of complex organic substances, nitrogenous or carbonaceous. It would seem, therefore, that some adequate substitute for the O.C. test is highly desirable because there are times when a rapid simple chemical test is needed to indicate the total reduceable matter as an alternate or adjunct to the B.O.D. test. Thus, an inadequate number of organisms in a sewage or industrial waste which contains toxic substances, or an unbalanced food content, may respond only partially to the food in the sample during the B.O.D. test while a good O.C. test could give a truer index of the amount of food present. The long incubation period of the B.O.D. test makes the results a matter of record only and

Table I

EFFECT OF VOLUME ON TEMPERATURE OF DIGESTION

A study of the effect of different amounts of water upon the temperature of digestion at constant volume and the amount of dichromate left after heating for a uniform period of time.

Acid Req.	Water added	Time of heating	Temp. of reflux.	Titre. 0.025N thiosulfate
ml.	ml.	mins.	°C	ml.
25.0	0	0	.....	25.5
25.0	0	60	155	19.2
25.0	10.0	60	145	24.7
25.0	20.0	60	135	24.2
25.0	40.0	60	123	23.3

*Research Associate Professor and Research Assistant respectively of the State Engineering Experiment Station of Georgia School of Technology, Atlanta, Ga.

Table III

Effect of Selenium Catalyst On Oxygen Consumed

Comparison of dilution B.O.D. values with the new dichromate oxygen consumed values × 0.68 for raw and settled sewages determined with and without selenium.

	Raw Sewage			Settled Sewage		
	Oxygen Con.		B.O.D.	Oxygen Con.		B.O.D.
Sample	No. cat. Ppm.	Selenium Ppm.	Ppm.	No. cat. Ppm.	With Sel. Ppm.	Ppm.
No. 1	353	454	282	172	159	127
No. 2	269	309	229	172	159	130
No. 3	271	390	373	155	167	126
No. 4	254	274	284	133	136	111
No. 5	289	320	387	208	211	161
No. 6	205	306	277	159	160	149
No. 7	....	....	....	169	171	152
Median	274	359	271	167	166	137

prevents its use for direct plant control, while a satisfactory O.C. test will give results within a period of time that may be helpful for plant control.

Recently, Rhame published[11] a method for the "Determination of B.O.D. Values by Chemical Oxidation." This test with modifications would seem to be a good substitute for the present permanganate O.C. test, because the new test is rapid, requires little attention, and yields values which give either reasonable correlation with the 20 day B.O.D. values of the samples or theoretical oxidation values for some pure organic compounds.

When Rhame published his method he realized that it would require some refinement in technic. This paper describes a procedure which includes several modifications of Rhame's technic and presents data showing the correlation between the modified O.C. values and the standard B.O.D. and O.C. values.

Method

Reagents

1. Dichromate oxidizing reagent:
   - 1 vol. of conc. sulfuric acid C.P. 95%
   - 1 vol. of orthophosphoric acid C.P. 85%
   - 1.25 g. potassium dichromate per liter
   - (Dissolve the dichromate in 20-25 ml. distilled water before adding acid)
2. Sodium iodide solution 20% C.P.
3. Sodium thiosulfate solution 0.025N standard
4. Soluble starch solution
5. Silver nitrate and potassium dichromate solutions for determining chlorides according to *Standard Methods*[3].

$$\text{O.C.} = \frac{\text{ml. blank} - 200\ (\text{ml. thio. for sample}) - 0.23\ (\text{ppm. Cl.})}{\text{ml. sample}}$$

Apparatus

1. 250 ml. Erlenmeyer flasks with outer 24/40 Standard taper neck
2. Reflux Condenser with inner 24/40 Standard taper fitting

Procedure

Place 25 ml. of the oxidizing reagent in the 250 ml. flask with 10 ml. of sample. This mixture will boil at 145° C. under a reflux condenser. If raw sewage is used approximately 5 ml. of sample will be needed, then 5 ml. of water must be added to provide a volume of 10 ml. of sample plus the 25 ml. of reagent. If a larger volume is needed for dilute samples such as effluents and stream samples, then the excess water must be removed by evaporation until the temperature of the mixture reaches 145° C. (35.0 ml. total vol.)

Place the flask plus sample over a burner and reflux 60 minutes so that the fumes do not rise higher than one inch above the lowest cooling surface of the condenser. Cool; rinse down reflux condenser with approximately 100 ml. water; cool; add 3 ml. potassium iodide solution; wait 5 minutes; and then titrate the free iodine with the standard thiosulfate solution.

The oxidizing reagent can be made up accurately enough to be a primary standard or checked against the thiosulfate solution. The blank of the oxidizing reagent should be determined without heating the reagent. Determine the chlorides in the sample. The results to be calculated are based upon the difference in the titrations of the thiosulfate with the reagent alone and with the reagent after it has reacted with the sample, and corrected for the concentration of chlorides in the sample.

This formula will give the O.C. value which will approximate the 20 day B.O.D. because it is based on complete oxidation. If it is multiplied by the factor of 0.68, one will obtain a value that will approximate the 5 day B.O.D.

A mixture of phosphoric and sulfuric acids is used in the oxidizing reagent because the phosphoric acid alone does not have a high enough boiling point while the sulfuric acid water mixtures of the proportions to give the desired temperature bump violently. An all-glass apparatus is recommended to prevent contact of the hot vapors with organic matter not in the sample. The beakers recommended in the Rhame's article[11] were discarded because of loss of the reagent and sample by splashing.

Experimental Development Of Method

The development of the procedure given above was carried out with solutions of 200 ppm. dextrose, starch, and peptone. This concentration was chosen because a 10 ml. aliquot of sample con-

Table II

Comparison of the Values Obtained By Oxidizing Three Organic Substances By Means of Three Methods of Oxidization

				Dichromate O. C.			Permanganate O. C.		Dilution B. O. D.	
Substance Oxidized	Conc. Used	Catalyst	Theoretical Oxygen Required	Average Experl. Value	Per cent of Theoret. Value	XO.68*	Average Experl. Value	Per cent of Theoret. Value	Average Experl. Value	Per cent of Theoret. Value
	Ppm.		Ppm.	Ppm.	Per cent	Ppm.	Ppm.	Per cent	Ppm.	Per cent
Dextrose	200	None	214	210	98	143	94	44	130	61
Dextrose	200	selenium	214	210	98	143	....	....	....	....
Starch	200	none	237	197	83	133	40	16	40	16
Starch	200	selenium	237	232	98	158	....	....	....	....
Starch	200	special seed**	237	....	....	....	....	....	110	47
Peptone	200	none	....	200	....	136	33	....	145	....
Peptone	200	selenium	....	210	....	143	....	....	....	....

*Experimental value of O.C. multiplied by 0.68. To compare with the 5 day B.O.D. values.
**Developed by aerating sewage with starch for several days prior to setting up the dilutions.

sumed about one-half of the dichromate of the oxidizing reagent in being completely oxidized. It soon became evident that the following factors must be studied:

(1) The correct titration value for the blank.

(2) The relative volume of water to be used with the oxidizing reagent during digestion and temperature of digestion.

(3) The length of time for refluxing the mixture.

(4) The use and choice of a catalyst for the oxidation of the organic matter in the sample by the dichromate.

(5) The effect of the concentration of the chloride ion.

When using a good grade of dextrose or starch whose exact formula is known, it is possible to calculate precisely the theoretical amount of dichromate that should be reduced by the sugar or starch as well as the experimental amount of dichromate which is actually used by the solutions of these substances. The correct titration value for the blank is very important for checking the theoretical values of the amount of dichromate reduced by the sugar and starch.

According to the present concepts, the blank value will be different for various conditions, so that several conditions were studied. When all of the water of the sample is evaporated off from a sample acid dichromate mixture, as indicated by the volume remaining in the flask, the temperature rises to approximately 155°C. The temperature continues to rise rapidly to 170°C. unless a reflux condenser is used to prevent the further loss of some volatile constituent.

As shown in Table I, the oxidizing capacity of the dichromate falls off rapidly when a blank is heated at 155°C. or higher. It is also true that the organic oxidation proceeds rapidly at these high temperatures, but it is difficult to choose the proper length of time of heating or the correct blank value when the time factor is so critical. The results shown in Table I indicate that 10 ml. of sample plus 25 ml. of acid dichromate reagent gives the blank value nearest to the value obtained without any heating, even though the blank containing 25 ml. reagent and 10 ml. water had a higher temperature during refluxing than those mixtures with more water. This would give the shortest digestion period with the least error from an excessive period of digestion.

The data of Table I further shows that the dichromate remaining decreases as the amount of water boiled with it increases. It is concluded from these data, that the dichromate was reacting with the water to form hydrogen peroxide which decomposed to give free oxygen and water. An experiment was set up with a constant volume of a reagent of pure phosphoric acid with dichromate and with varying amounts of water. The phosphoric acid water mixtures had much lower temperatures of refluxing (105-115°C.), but the results again indicated that the water reacted with the dichromate. It is important to know whether hydrogen peroxide under these conditions will oxidize organic matter first or break down first. The problem was attacked experimentally by making up a small volume of 1:1 sulfuric-phosphoric acid mixture containing 0.5 per cent by volume of 30 per cent hydrogen peroxide. Ten ml. of 200 ppm. dextrose solution was refluxed with 25 ml. of the acid peroxide reagent for one hour. Then one ml. containing 31 mg. potassium dichromate (the amount in 25 ml. of the acid dichromate reagent) was added and the heating continued for one hour. There was no reduction in the dichromate after the hour's heating. This indicated that the hydrogen peroxide had oxidized all of the sugar before the dichromate was added. It was concluded

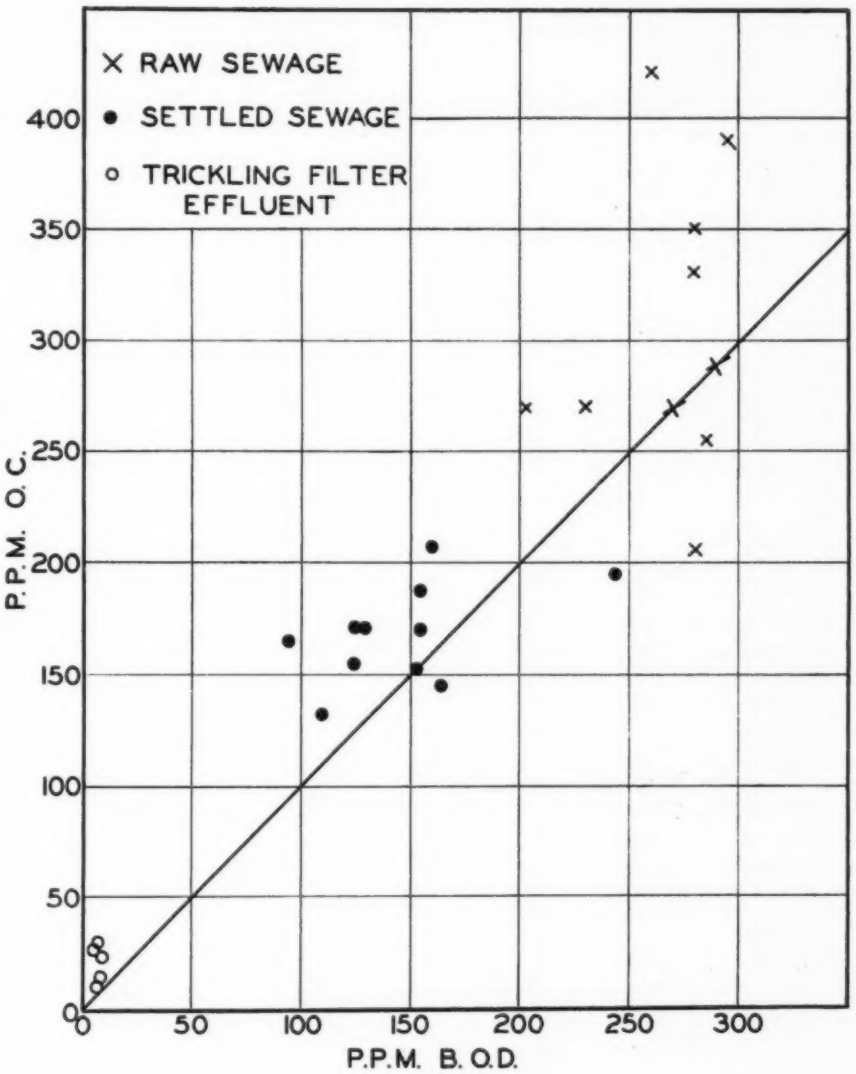

Fig. 1. Comparison of the B.O.D. Values with the New Dichromate O.C. Values

(The O.C. values of a number of sewage and effluent samples multiplied by 0.68.)

that the hydrogen peroxide will oxidize the organic matter before breaking down if any is formed during the digestion period and that no correction should be made in the dichromate titration run on the reagent directly in the cold.

Because of the simple procedure that has been outlined above in the absence of chlorides, the determination of dextrose was repeated in the presence of several different concentrations of chlorides. The average of six determinations at each of four different chloride concentrations showed that the dichromate was reduced by the amount theoretically required to oxidize the chloride to chlorine in concentrations up to 240 ppm. chloride in the presence of dextrose.

From the data presented above, it was decided to use the mixture of 10 ml. of sample with 25 ml. of acid dichromate reagent in order to attain the highest possible digestion temperature with the smallest breakdown in the dichromate if an excessive time of refluxing was used.

Results

When the dextrose solution was analyzed under these conditions, it was determined as shown in Table II that there occurred a 98 per cent reduction in the equivalent amount of dichromate in 20 minutes. Only an 83 per cent recovery of starch could be obtained in 60 minutes of refluxing until selenium, which is a well recognized catalyst for organic oxidations, was added. The selenium increased the starch oxidation to 98 per cent and yet did not cause an excessive value for the dextrose oxidation. A large number of other catalysts were tried without any success. The increase of the peptone O.C. value when using selenium makes it appear that for many complex substances one should use the selenium catalyst, but the small increase indicates either that the oxidation with the selenium was complete or that a better catalyst must be found. It was concluded that heating, refluxing, for one hour with selenium will give complete oxidation.

The permanganate O.C. values shown in Table II are in very poor agreement with the theoretical values for the oxidation of starch and sugar. The dilution B.O.D. values shown in Table II for dextrose and peptone are in good agreement with previously published values for these compounds. The basic chemical identity between starch and dextrose means that starch should have the same or slightly higher B.O.D. than dextrose. The need for a special seed to attain this B.O.D. value for starch indicates the need for special precautions for all B.O.D. determinations on industrial wastes and the poor seeding characteristics of ordinary sewage under certain conditions. The high concentration of the acids in the acid dichromate reagent makes the reagent an excellent solvent for paper. The dispersed paper gives an O.C. value that compares with starch. Since the dilution method for B.O.D. gives no oxygen demand for paper, this will be a source of discrepancy in the analysis of raw sewage.

A comparison of the dilution B.O.D. values with the new dichromate O.C. values multiplied by 0.68, for a number of sewage samples, is presented in Fig. I and Table III. The results indicate that the O.C. values x 0.68 run somewhat higher than the dilution B.O.D. values. This might be expected from the presence of substances known to be oxidizable chemically but not biologically, such as paper and humus. The differences in the B.O.D. and dichromate O.C. values are increased by the selenium with the raw sewage, but the O.C. values are not increased by the selenium with the settled sewage. This indicates that the settled sewage does not contain as much material which resists oxidation as does the raw sewage.

Discussion

There are several interesting differences between this dichromate O.C. procedure and the one suggested by Adeney and Dawson son[2] or Abbott[3]. Both of those older procedures removed the chlorides before digesting the sample with the dichromate, while this proposed procedure recommends a separate determination of the chlorides and an arithmetic correction during the calculation. It is obvious that the accuracy of any of the three methods will decrease as the ratio of the chlorides to the organic matter increases.

The two earlier procedures controlled their temperatures externally by using steam (1) or a thermostat with hot plate (2), while the digestion temperature of this procedure is controlled by the boiling point of the mixture of 25 ml. of the sulfuric-phosphoric acid reagent with 10 ml. of the sample. Each of the three procedures are alike in determining the O.C. value by calculating the dichromate reduced from the difference in the amount of dichromate remaining after digestion and the amount present originally or in a blank. By using some (but not an excessive amount of) water, the need for running a blank with each set of samples in this procedure has been eliminated; whereas the earlier procedures removed all water from the digesting mixture to permit a direct breakdown of the dichromate.

Because many organic molecules contain some oxygen in their structure, this O.C. test, which measures the reducing equivalents in an organic mixture, would seem to be a better method for measuring the strength of sewage or industrial wastes than the complete organic carbon methods which measure the carbon dioxide evolved. Further, this proposed O.C. test is easy to conduct, uses simple apparatus, and is rapid.

In Rhame's[1] article, the median values for the dichromate O.C. test using the 0.68 factor and B.O.D. values were roughly equivalent, while with the present procedure for the O.C. test, the O.C. values are all higher than the dilution B.O.D. values. On a purely theoretical basis, the O.C. value which is based on complete oxidation should run higher than the B.O.D. value unless there has been either (1) poor sampling, (2) a loss of sample or reagent during the O.C. test, or (3) an apparent failure of the reagent to oxidize the sample due to the use of a low blank titration value in the O.C. calculation. Where pure food substances are used, the O.C. and B.O.D. values can and do approach each other very well.

Summary

This paper presents a rapid analytical procedure for determining chemically the amount of oxidizable material present in sewage. A small aliquot of sewage is added directly to a small volume of a 1-1 mixture of phosphoric and sulfuric acids plus some potassium dichromate and the mixture refluxed for sixty minutes in the presence of selenium. The amount of dichromate remaining after ox-

idizing the sewage is determined chemically and the oxygen consumed value is calculated by the difference in the dichromate present originally and finally, and is corrected for the chloride concentration of the sample.

Acknowledgement

The work of this paper is part of a project supported by a grant-in-aid from the National Institute of Health of the United States Public Health Service for research upon rapid analytical procedures for water and sewage. The samples of sewage were provided by Mr. Ray, the sewage plant chemist for the City of Atlanta, who delivered them daily while collecting his samples from the small city plants.

Literature Cited

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WATER AND SEWAGE PATENTS

(Of Recent Issue)

WATER PATENTS

Scraper Structure For Liquid Treatment Tanks. Ewald A. Kamp (to Graver Tank & Mfg. Co., Inc.); U. S. 2,427,092; Sept. 9, 1947 (Appl. 8-26-44). Flocculation and sedimentation tank with central influent chimney, radial flow to outer circular wall, and scraper mechanism operated from revolving superstructure.

Pipeline Swab. Joseph F. Stephens, (to Gustin-Bacon Mfg. Co., Kansas City, Mo.); U. S. 2,427,632; Sept. 16, 1947 (Appl. 8-16-43). A mechanical device for cleaning encrusted pipelines.

Spherical Tank. George T. Horton (to Chicago Bridge & Iron Co., Chicago, Ill.); U. S. 2,427,676; Sept. 23, 1947 (Appl. 3-1-1945). A spherical storage tank comprising a hollow sphere and supporting structure.

Upflow Water-Treating Apparatus. James D. Walker (to the American Well Works, Aurora, Ill.); U. S. 2,427,866; Sept. 23, 1947 (Appl. 10-4-43). Water treatment apparatus with outer cylindrical tank and an inner cylindrical tube with communicating means between and an axial flow pump for moving the water down the inner tube and up the outer annular cylinder and through a slurry in the bottom.

Process of Removing Bacteria From Fluids. Garnet Philip Ham and Robert Bowling Barnes (to American Cyanamid Co., New York); U. S. 2,428,328; Sept. 30, 1947 (Appl. 9-5-42). A process for removing bacteria from aqueous media by passing it through a dielectric material activated by 100-2000 volts.

These patent abstracts being brief do not necessarily cover the entire scope of the invention described. If the reader becomes especially interested in any of these patents, he should obtain printed copies of the complete patent, at 25 cents each, from the Commissioner of Patents, Washington 25, D.C.

Removal of Bacteria from Fluids. Garnet Philip Ham and Robert Bowling Barnes (to American Cyanamid Co.); U. S. 2,428,329; Sept. 30, 1947 (Appl. 9-5-42). Similar to U. S. 2,428,328.

Removal of Silica and Other Impurities From Water by Precipitation. Paul C. Goetz and Howard L. Tiger (to The Permutit Co., New York City); U. S. 2,428,418; Oct. 7, 1947 (Appl. 7-3-40). Process of removing impurities from water by increasing the magnesium content of water by subjecting it to contact with a magnesia bearing material and thereafter adding lime to precipitate the ionic magnesium with agitation that causes intimate contact of the water and the precipitated sludge.

Sedimentation Chamber for Separating Solids from Liquid Having Flow Distributing Means Therein. Arthur C. Lind (to Chain Belt Co., Milwaukee, Wis.); U. S. 2,428,756; Oct. 7, 1947 (Appl. 4-14-44). Sedimentation tank for separating solids from liquid, with baffles at both inlet and outlet ends to maintain stratified horizontal flow, thereby improving sedimentation and eliminating short circuiting.

Attachment Means for Conveyor Flights. Arthur C. Lind (to Chain Belt Co.); U. S. 2,428,757; Oct. 7, 1947 (Appl. 6-29-44). A conveying mechanism for solids and means of attaching flights to link chain.

Water Elevating and Distributing System. Archie S. Feinberg, Dallas, Texas. U.S. 2,428,842; Oct. 14, 1947 (Appl. 2-4-46). An evaporative cooler system consisting of two rotating parallel discs which pick up and discharge water on side filter mats.

Liquid Level Indicating and Means. Frank P. Scully and Alcide E. Mathey (to Scully Signal Corp., East Cambridge, Mass.)

U.S. 2,429,280; Oct. 21, 1947 (Appl. 9-19-41). A gas operated sound producing device positioned in path of gases escaping from a tank being filled.

Solids Separator. Walter H. Green (to Infilco, Inc., Chicago, Ill.) U.S. 2,429,315; Oct. 21, 1947 (Appl. 3-1-41). A circular sedimentation tank of the two section up-flow type with necessary appurtenances for mixing, settling, and withdrawing sludge and clarified liquid.

Process and Apparatus for Improving Clarification of Turbid Liquors By Use of Partially Thickened Sludge. Walter H. Green (to Infilco, Inc., Chicago, Ill.) U.S. 2,429,316; Oct. 21, 1947; (Appl. 10-26-42). A liquid treating apparatus of the up-flow type for the coagulation and clarification of water.

Automatic Self-Cleaning Water Strainer. Franklin R. Magill, Lebanon, Pa. U.S. 2,429,417; Oct. 21, 1947 (Appl. 1-61-45). A coil spring straining unit with backwashing facilities.

Valve. Henry W. Boteler (to Grinnell Corp., Providence, R.I.). U.S. 2,429,602; Oct. 28, 1947 (Appl. 7-27-44). A diaphragm type valve.

Dry Feeding Machine Having Means Responsive to Weight of Material Already Discharged From Automatically Movable Hoppers. Grove D. Alvord (to Syntron Co., Homer City, Penna.). U.S. 2,429,864; Oct. 28, 1947 (Appl. 10-16-43). Dry feed device with electrically operated vibratory motor and vibratory conveyor with feed controller.

Passing Liquid Downward Through First and Second Beds of Zeolite and Thereafter Passing Liquid Downward Through Second and First Beds of Zeolite. Frank D. Prager (to Graver Tank & Mfg. Co.) U.S. 2,429,943; Oct. 28, 1947 (Appl. 12-18-44). Process comprising repetitive steps using organic zeolite in hydrogen cycle.

Tool For Lining Pipe. Harry Browning (to E. I. duPont deNemours & Co., Wilmington, Del.). U.S. 2,430,273; Nov. 4, 1947 (Appl. 11-14-45).

Pump. John Mann (to Goulds Pumps, Inc., Seneca Falls, N.Y.). U.S. 2,430,299; Nov. 4, 1947 (Appl. 3-9-44).

Material For Treating Boiler Feed Water and Preparation Thereof. Thomas L. Pankey and Carroll E. Imhoff (to Allis-Chalmers Mfg. Co., Milwaukee, Wis.) U.S. 2,430,300; Nov. 4, 1947 (Appl. 1-20-45). A process of producing an activated silica absorbing material for treating water containing silica.

Self-Priming Pump. Frederick W. Heckert and Russell R. Curtis (to Curtis Pump Co., Dayton, Ohio). U.S. 2,430,337; Nov. 4, 1947 (Appl. 3-25-44). A portable compact pump and motor unit.

Anion Exchange Resin Prepared With Urea, Paraformaldehyde, and Aniline Hydrochloride and Process of Removing Acids from Liquids Therewith. Eric Leighton Holmes (to The Permutit Co., New York, N.Y.) U.S. 2,431,251; Nov. 18, 1947 (Appl. 2-2-44). A process for preparing an anion exchange resin.

Water Pump Refacing Tool. William B. Chiles, Lubbock, Tex. U.S. 2,431,369; Nov. 25, 1947 (Appl. 5-14-46). A tool grinding mechanism for re-surfacing pump seal surfaces.

Storage Tank. George T. Horton, (to Chicago Bridge & Iron Co., Chicago, Ill.) U.S. 2,431,693; Dec. 2, 1947 (Appl. 2-9-44). Cylindrical storage vessel.

Water - Softening Apparatus Having A Valve for Admitting Reactivating Agent Thereto. Homer J. Shafer, (to Westinghouse Electric Corp., East Pittsburgh, Penna.) U.S. 2,432,178; Dec. 9, 1947 (Appl. 7-4-44). Water softening apparatus for regenerative material.

Sludge Tank Having A U-Shaped Conduit Having Arm Portions Inclined Downward to the Lower Part of Said Tank And A Conduit Opening Into Said Tank Connecting Portions. Henry W. Hapman, Detroit, Mich. U.S. 2,432,756; Dec. 16, 1947 (Appl. 1-15-44). A sludge removal apparatus consisting of a chain of continuous flights operating in a U-shaped closed conduit.

SEWAGE PATENTS

Apparatus for Controlling the Rate of Discharge From a Liquid Distributor From Changes in the Liquid Head Within the Distributor. Herbert W. Gillard (to Infilco, Inc., Chicago, Ill.) U.S. 2,429,312; Oct. 21, 1947 (Appl. 3-5-43). A sewage treatment apparatus comprising a trickling filter bed, and a rotating sewage distributor, with a power actuated flow regulating device operating in accordance with the change of head on the center column of the rotating distributor.

Self-Adjusting Sump Pipe. Per E. Alden (to Kenmore Builders Supply Co., Inc., Buffalo, N.Y.) U.S. 2,429,541; Oct. 21, 1947 (Appl. 8-20-45). Hydraulic receiver to be installed in a drain pipe.

Diaphragm Pump. Walter F. Wesley, Minneapolis, Minn. U.S. 2,430,545; Nov. 11, 1947 (Appl. 6-18-45).

Sewage Disposal Equipment. John W. VanDenberg, New York, N.Y., U.S. 2,430,749; Nov. 11, 1947 (Appl. 7-19-45). Air diffusing means consisting of a header, an outlet which limits escape of air according to position of outlet and a porous diffuser tube.

Back Water Trap for Drains. George A. Hull, Detroit, Mich. U.S. 2,431,399; Nov. 25, 1947 (Appl. 5-28-45).

Automatic Sewer Flood Control. Arthur Gordon, Chicago, Ill. U.S. 2,431,640; Nov. 25, 1947 (Appl. 6-9-45). An automatic back-water locking gate consisting of a sump, conduit through the sump, gate operated automatically to close off back water in case of flood.

Sewage Disposal Apparatus Comprising a Septic Tank and an Evaporating Tank Having a Vent. Lyman J. Haviland, Mundelein, Ill. U.S. 2,432,887; Dec. 16, 1947 (Appl. 9-14-44). Septic tank system for small home or farmhouse.

Sewer Pipe Branch Locator. Merle H. Clapper, Delavan, Wis. U.S. 2,433,028; Dec. 23, 1947 (Appl. 1-24-45). A signalling device for locating a branch in a tubular conduit.

SHAKER HEIGHTS ADDS TO PROPERTY VALUES

By Successful Conversion of Unsightly Open Ditch to Residential Boulevard

By FRED A. PEASE*

SHAKER Heights, known as "The City of Beautiful Homes," is situated on a hill with a commanding view of the City of Cleveland where the majority of its residents carry on their business. The city received its name from the early settlers of the area who were known as "Shakers." They were a religious group formed as an outgrowth of English Quakerism. It is claimed their fervor agitated them during their religious ceremonies to the point of trembling, shouting, jumping and shaking—from which comes their name—"Shakers." They settled the area in 1823 and were organized in three large family groups—The North Family, Middle Family and East Family, living in large community houses.

The Shakers were industrious, hard working people who provided themselves with all their requirements, but as marriage was not permitted they depended entirely on new converts to maintain their membership. Unsuccessful in obtaining sufficient converts, their numbers dwindled and in 1889 they sold their 1366 acres of land now comprising Shaker Heights for $316,000—a fraction of its present value, of course.

*Municipal Engineer, Shaker Heights, Ohio.

Development of Shaker Heights

About 15 years later O. P. and M. J. Van Sweringen obtained options on parcels of land in the Shaker area and this development served as a springboard for the Van Sweringen Brothers ventures in real estate, railroads and finance, making them nationally known figures in these fields.

Shaker Heights was developed from a master plan and protective restrictions with the vision and backing of the Van Sweringen's and under the direction of capable administrators. William J. Van Aken, Esq., has continuously served as Mayor of Shaker Heights since 1915. Shaker's attractive curved streets were laid out by The F. A. Pease Engineering Co., who have a record of continuous service as City Engineers similar to that of the Mayor.

Reminiscent of its early history, the city has a few hills and dales. These are now surrounded by developed property and form nothing more than unsightly gullies which are also detrimental to the tax duplicate.

1947 Improvements

The City Council, in the Spring of 1946, authorized the F. A. Pease Engineering Co. to take the necessary steps for the elimination of one such gully located in an area zoned for apartments and a shopping district.

After a careful survey, the Pease organization changed the alignment from the location of the old meandering stream so that the new structure would be under the proposed extension of Winslow Road and follow property lines of the abutting parcels, thereby simplifying the problem of obtaining easements.

In accordance with the Pease design a contract was awarded in October, 1946, for the construction of a corrugated metal arch culvert using an integral concrete floor and footers extending 18 inches above the floor. A 10-foot span arch was planned for 780 lineal feet and a span of 8 feet for 830 lineal feet.

Contract for the construction was let to Darin & Armstrong, Inc., General Contractors of Detroit and Cleveland, on their low bid of approximately $82,000 which included excavation, backfill and special connections. The material selected was Armco Multi-Plate for the arches and Armco Corrugated pipe, all bituminous coated.

Two Reverse Curve Sections of Multi-Plate Arch Sewer
Note locations of corrugated pipe risers forming manholes.

Installation of Multi-Plate Arches

Construction was started in December, 1946. Immediately following excavation the contractor poured the reinforced concrete base imbedding in the footers a special galvanized iron channel to receive and bolt the Multi-Plate Arch. As the concrete base progressed, a three man crew set the metal arch with skeleton bolting, then as time permitted the remainder of the bolts were inserted and all tightened. As the new structure crossed the old stream bed in a number of places, temporary openings had to be provided. This was easily accomplished by omitting one section of Multi-Plate which later was bolted in the structure.

Stubs for the 30 inch diameter corrugated metal pipe manholes were attached to the Multi-Plate in the fabricating plant and the extensions were attached in the field, using standard bolted connecting bands. Some of the sewer connections could not be located in advance and the contractor used a cutting torch to cut the Multi-Plate for these to enter. The burnt edges were re-coated with bituminous material and a shop fabricated saddle branch was bolted to the Multi-Plate covering beyond the burned area, thus providing a stub for the lateral sewers at the angle required for the job.

The Multi-Plate was specially fabricated to form the transition between the eight and ten foot span arches. The junction with existing rectangular concrete box culverts at both ends was accomplished by butting the Multi-Plate to the box culvert and pouring a concrete encasement.

As this was a winter construction job and the specifications required a well compacted backfill, this operation was carried on only as weather permitted and was completed in May, 1947.

Grading for new Winslow Road is complete and early pavement is planned. The area has already increased in value and provides an attractive site for apartment buildings.

W. B. Hecker was supervising engineer of construction for The Pease Engineering Co. Rudy Reif is Director of Public Service for Shaker Heights.

The Darin & Armstrong contract operations were under the general supervision of E. Connerth with Jack Gibbons as project foreman.

FIRST INTER-AMERICAN SANITARY ENGINEERING CONGRESS

To be Held in Santiago, Chile, April 8-14. Exhibits a Feature

The Chilean Section of the Inter-American Association of Sanitary Engineering (IAASE) announces definite plans for the First Inter-American Sanitary Engineering Congress. The meetings of the Congress will be held in the University of Chile, Santiago, Chile, during the period April 8-14, inclusive. Sponsoring agencies of the Congress include the Chilean Section (IAASE), the Ministry of Public Works of Chile, the Ministry of Public Health of Chile, the Department of Water and Sewerage of Santiago, the Pan-American Sanitary Bureau and the Institute of Inter-American Affairs.

This Congress will follow the pattern of the two preceding regional meetings held in Rio de Janeiro, Brazil, and Caracas, Venezuela, in 1946, and there will be in attendance not only sanitary engineers, but public health and public works officials and allied professionals from all the American Republics.

Specific details of the well balanced program of the Conference will be released shortly. Among the outstanding items of interest to those who will be in attendance are inspection trips to Las Vizcaches Water Treatment Plant and the Villa Alemana Sewage Treatment Plant near the famous ocean resort of Viña del Mar.

University of Chile, Santiago.

One of the most important matters to be placed on the Congress' agenda is the establishment of the Inter-American Association of Sanitary Engineering on a permanent basis.

A large exhibit of water works and sanitation equipment will be staged in the exhibit hall adjacent to the University of Chile auditorium and will be an important adjunct to the meeting.

For further information on the Congress, inquiries may be addressed to the conference chairman, Mr. Ruperto Casanueva, Departmento Cooperativo Interamericano de Obras Sanitarias, Tenderini 127, Santiago, Chile, or to the Inter-American Association of Sanitary Engineering, c/o Donald L. Snow, Acting Secretary, 2001 Connecticut Avenue, N. W., Washington 8, D. C.

Arrangements for exhibits by U. S. manufacturers are being handled through Mr. Arthur T. Clark, Secretary-Manager, Water and Sewage Works Mfgrs. Ass'n., 170 Broadway, New York 7, N. Y.

SANITARY ENGINEERING DIVISION OF A.S.C.E.

Holds Two Sessions in New York

As a part of the annual meeting of the American Society of Engineers, Jan. 21-23, the Sanitary Engineering Division held its sessions in the Commodore Hotel in New York City. The program was devoted almost entirely to papers dealing with the sanitation of rivers and harbors and progress in sewage treatment by Boston, New York and Philadelphia.

Chairmen

Incoming	Outgoing
H. M. Freeburn	*Gordon M. Fair*
Chief Engr.	*Dean of Engr.*
Phila. Sub. Water Co.	*Harvard Grad School*
Bryn Mawr, Pa.	*Cambridge, Mass.*

The morning session, presided over by **Dean Gordon M. Fair,** Chairman of the Executive Committee of the Sanitary Engineering Division, was devoted entirely to a symposium on operations of authorities concerned with the sanitation of rivers and harbors.

New England Compact

The first speaker on the session was **Warren J. Scott,** Director of Bureau of Sanitary Engineering, Connecticut Dept. of Health, Hartford, Conn., who presented a paper on *"Legal Aspects of Compact Legislation in New England."* In beginning his discussion of the New England compact, Mr. Scott pointed out that the proposed stream pollution abatement bill in Congress, (S-418) supports the idea of inter-state compacts. The New England compact, it is believed, can well represent that area.

Membership of the commission is made up of five men from each state. To date three states have ratified the compact and it has become effective.

The first task of the New England compact was to establish standards for the classification of water for its highest use. It has been expected that each state will work out the classification within its own boundaries. Each state pledges to abate pollution and to protect inter-state water. The legislatures of Connecticut, Massachusetts, and Rhode Island have approved the pact and it has been put into effect. Stipulation is made in the compact whereby N.Y. State can join insofar as certain of its waters are inter-state to the New England states.

According to Mr. Scott, success of the compact needs the cooperation of the several states and the working out of a long range plan.

Stream Classifications Under New England Compacts

The *"Classification of Streams under Consideration for Compacts in New England"* was the title of the paper presented by **Arthur D. Weston,** Director and Chief Engineer, Mass. Dept. of Public Health, Boston, Mass. Mr. Weston reviewed the work of classification which was really started in 1935. A committee filed a report in 1941 and from that grew the New England compact. There are four different classes: Class A for use as a source of drinking water and the propagation of shell fish; Class B for bathing water; Class C for boating, fishing, and industrial supply; Class D for commercial navigation.

Class A waters are expected to have a coliform bacteria content of less than 50 per 100 ml., whereas Class B waters may have a coliform bacteria content of up to 1,000 per 100 ml. These waters must also be clear and contain dissolved oxygen. Class C and D waters are obviously of poorer quality, but all should contain some dissolved oxygen.

As a part of the presentation, Mr. Weston showed slides of the condition of several rivers in Massachusetts, indicating the condition as the streams come into the state, what happens to them when passing communities, and the condition as they go out. With one exception, i.e., the French River, all streams entering Massachusetts are now better than Class D, and it is Mr. Weston's belief that they should be kept at Class C within the state, and leave at least in Class C condition.

Secretary	Exec. Com. Mem.
John H. O'Neill	*F. W. Jones*
Chief Engr.	*Havens & Emerson*
La. Dept. H'lth	*Cons. Engrs.*
New Orleans, La.	*Cleveland, O.*

Interstate Sanitation Commission

The Interstate Sanitation Commission is composed of New York, New Jersey, and Connecticut and has been in existence for a number of years. The *"Operations of the Interstate Sanitation Commissions"* were described by **Seth G. Hess,** Director and Chief Engineer of the Interstate Sanitation Commission, New York, N. Y. Mr. Hess explained that the basic part of the standards set up by the Interstate Sanitation Committee was not the quality of the water, but the quality of the material pollution entering the water. There is, however, a stipulation regarding the dissolved oxygen content of the receiving waters.

This compact authorizes the commission to issue orders to municipalities, and to bring court action if necessary. In these respects, the commission differs from other commissions. To date it has avoided the use of its preemptory power, preferring to work through state agencies. In 12 years (no construction during the war) new plants for about one-half of the population tributary have been designed and put into operation. When a city sets its

own schedule for construction, the commission holds off any action. In the 12 years of operation there have been only two cases in which the municipalities have been cited for delay. In the smaller cities, the commission allows up to three years for the carrying out of the program once it is put under way.

There is a second group of polluters with which the commission is concerned. These are the industries and real estate developments. If municipal treatment is available and will solve most of the industrial problems, recommendations are, wherever feasible, that industrial wastes be taken into the municipal sewers. The same is true of real estate developments.

The commission watches over such things as chlorination, bypasses, storm water overflow, etc. Sewers are designed for dry weather flow plus the first flush of rain storm.

Whereas it is quite usual for designers to consider rain fall frequencies of one year and more, design for rainfall frequencies of less than one year is not generally available. The commission, however, has established and developed a density curve for rainfall frequencies of less than a year and therefore it is possible to design sewage treatment works and sewers in this area to take care of the dry weather flow plus the first flush of all types of rainstorms.

Delaware River Basin (Incodel)

According to **James H. Allen,** Executive Secretary, Interstate Commission on the Delaware River Basin, *"Operations of the Interstate Commission on the Delaware River Basin"* are somewhat different as to their legal pattern than other commissions of similar purpose. Incodel is an agency consisting of the states of New York, New Jersey, Pennsylvania, and Delaware. The agency was created by legislative acts of the various states and not by compact.

In order to find a practical policy to put an end to pollution of the Delaware River, efforts were started with a conference of the chief sanitary engineers of the four states meeting once a month for a period of two years. From these meetings developed the plan for the creation of Incodel. This plan was founded on the assumption that the state and local agencies could do the job of stream pollution abatement.

After it became evident that a correlated action by the four states was necessary, certain steps were taken. The river and its tributaries were divided into four zones and reasonable and minimum standards were set for those four zones. Secondly, through the chief engineers, Incodel adopted a time schedule for proceeding with the abatement of pollution of these various zones. These ideas were then given legislative sanction by the four states.

In its operation, Incodel has not superceded any part of the government. It has progressed by getting the cooperation of industries,

New England Compact

Warren J. Scott
Chief Engr.
Conn. Dept. H'lth
Hartford, Conn.

Arthur D. Weston
Dir. & Ch. Engr.
Mass. Dept. Pub. H'lth
Boston, Mass.

cities, and states. Even the cities of Philadelphia and Camden, N.J., have both developed programs to undertake pollution abatement. The former program will cost $60,000,000.

One of the worst pollution problems was the coal mining pollution of the Schuylkill River, where the coal culm amounted to many millions of tons a year. Study of this problem by Incodel brought about a joining of hands of the Federal government and the state of Pennsylvania to relieve this problem and the abatement program is proceeding smoothly.

In closing, Mr. Allen said that Incodel was more in harmony with home rule than was Federal legislative action and had been successful as operated by this commission.

Tennessee Valley Authority

Speaking on *"Operations of the TVA,"* Chief Public Health Engineer, **Robert N. Clark,** Tennessee Valley Authority, Chattanooga, Tenn., pointed out that the use of the stream affects an entire region and therefore its use should be considered in light of the economic and social status of the region.

In the case of TVA, technical services are provided to the states concerned only where such services are not available in the state. In addition, it has on its own authority developed stream pollution surveys, most of them carried on with the assistance of state agencies. Development of these stream pollution studies has permitted the development of remedial measures in many cases. Mr. Clark explained how TVA had been helping in the states of North Carolina and Alabama.

TVA does not set standards for the stream but has conferred with the several state agencies and has a policy of advocating the doctrine of reasonable use. From this proposal the states develop their own standards for the stream within its boundaries.

In closing, Mr. Clark said that the final step in the abatement of stream pollution could involve compulsory action as well as voluntary action. However, any mandatory action must be handled as a state action. It is the proposal of the TVA that Federal interest withdraw as the stream becomes freed of its pollution. Control will then be left entirely to the states concerned.

SYMPOSIUM ON SEWAGE DISPOSAL INTO TIDAL RIVERS AND HARBORS

The afternoon session of the Sanitary Division was devoted to progress reports from Boston, New York City, and Philadelphia on sewage treatment and disposal into tidal waters. The closing feature of the session consisted of a comprehensive review of progress and trends in sewage and industrial waste treatment by the Division's Committee on Sewage Treatment, headed by Langdon Pearse of Chicago, who always produces an interesting contribution with its suggestive, if not provocative, comments.

Progress at Boston

A brief description of *"The Nut Island Treatment Works of Boston,"* and construction progress on this plant, was presented by **Karl R. Kennison,** Chief Engr., Metropolitan Distr. Comm., Boston, Mass.

Interesting features of the plant, which will provide primary treatment, and chlorination, in-

clude disposal of digested sludge to sea through a long force-main of 20 in. C.I. Pipe to deep water, with flexible mechanical joints on the submarine section of the line.

The next Boston project will be an extension of the North Outfall sewer to Deer Island where the sewage will be given primary treatment and chlorination, as at Nut Island. Digested sludge from Deer Island will also be pumped to deep water after digestion.

Progress at New York

In reporting on *"Sewage Treatment Progress at New York,"* **Richard H. Gould,** Director Div.

Commissions

Seth G. Hess
Chief Engr.
Interstate San.
Comm. N.Y.C.

Jas. H. Allen
Exec. Sec'y
INCODEL
Phila., Pa.

of Engineering, Dept. of Public Works, New York City, had the following to say in his paper presented by Gail P. Edwards, Chief Chemist, Dept. of Public Works.

New York, with treatment now given in the Wards Island, Jamaica Bay, Coney Island, Bowery Bay and Tallman's Island plants, has a record of very satisfactory improvement of the waters of the area now receiving about 600 million gallons of treated sewage daily. In addition to the 6 modern plants now operating plans call for a 240 m.g.d. extension of the Wards Island Plant, 280 m.g.d. for the projected Newtown Creek Plant and 160 m.g.d. for the Owl's Head Plant, on which bids are being advertised. Construction has been resumed in the 60 m.g.d. 26th Ward Plant and plans and specifications are complete for additional construction of $80,000,000 value.

Mr. Gould pointed out the economy of the short period "Modified Aeration" being adopted in all new New York plants on the strength of reliable performance recorded for the plants now utilizing such short period aeration, with the maintenance of a prescribed limit on the age of recirculated sludge in the system as an important consideration. All plants will employ sludge digestion and power recovery through engines equipped as Dual-Fuel Engines to supplement the gas supply with fuel-oil to the required degree at such times as digestion fails to keep pace with peak power requirements.

Mr. Gould also pointed out the fallacy and poor economy of treating sewage to a point much beyond that of the minimum requirements. The sufficiency of 60% purification rendered by the large Jamaica Bay plant and the 75% and better purification by chemical precipitation at the Coney Island Plant was cited. To exceed such treatment would be to invite trouble from algae growths on top of a waste of money for unnecessary power requirements and cost of plant construction and maintenance.

Progress at Philadelphia

In reporting on *"Sewage Treatment Progress at Philadelphia, Pa.,"* the joint paper by **M. B. Tark,** Chief Engr. and **S. S. Baxter,** Assoc. Engr. of Design, Dept. of Public Works, Philadelphia, Pa., was read by Mr. Baxter. This paper gave a brief description of the 125 m.g.d. Northeast Treatment Works now under construction, to provide primary settling, modified aeration (0.3 cu. ft./gal.) with a 2½ hr. period patterned after the New York City scheme. The mixed sludges will be preheated and given two-stage digestion designed for maximum flexibility in respect to methods of operating the digesters, sludge transfer, recirculation, etc. Heating of sludge is to be accomplished with a submerged heating unit within which the gas is burned to provide economical direct heat transfer. The digested sludge will be disposed of in vast lagoons calculated as ample for 10 years of sludge output.

Aeration is to be provided through tubular diffusors of the type which can be readily elevated out of the aeration tanks for inspection, repair, etc. Final settling tanks will provide 2 hrs.' detention. Air-cleaning, given especial consideration, will be secured by electrostatic units. Sludge digesters (4 batteries) are to be constructed of pre-stressed concrete. Gas will be stored in a 50,000 cu. ft. gas holder. For disposal of supernatant liquor, the Kraus Process (Peoria, Ill.) is under consideration.

Already contracts have been let in the amount of $7,000,000 and the schedule calls for the plant to go into service on Sept. 1, 1949, after which construction will begin on the smaller projected Southeast and Southwest plants.

PROGRESS AND DEVELOPMENT IN SEWAGE TREATMENT

As the closing feature of the Sanitary Division's sessions the *"Report of the Committee on Sewerage and Sewage Treatment"* was presented with interesting

Sewage Disposal

New York
Rich. H. Gould
Dir. Div. Engr.
Dept. Pub. Wks.

Boston
K. R. Kennison
Chief Engr.
Metro. Dist. Comm.

side comments by the chairman of the committee, **Langdon Pearse,** Sanitary Engineer, Sanitary District of Chicago.

It is of course impossible to effectively review such a voluminous report in the space here available. Some of the high-spots were the following. The famous Activated Sludge patent suits had finally been settled at an overall cost of $2,500,000 to U.S. municipalities. It had cost Chicago more than $400,000 and Milwaukee more than $300,000 to fight the suit, all of which seemed unfortunate when recalling that Milwaukee could have settled originally for $25,000 and Chicago for $65,000.

In commenting on industrial pollution abatement the report cited the interesting decree of Maine's Supreme Court which enjoins the important paper mills from discharging wastes in excess of that which reduces the dissolved oxygen in the receiving Androscoggin River below 4 ppm. and orders construction of equalizing lagoons to store the excess wastes. The court has appointed a chemist to watch stream conditions and supervise the operation of the lagoons to insure the maintenance of not less than the mini-

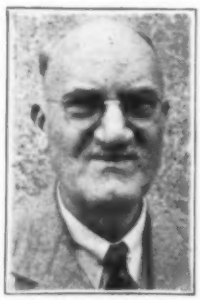
mum dissolved oxygen specified. Interesting is the fact that the paper mills are required to pay the chemist named in the court's decree as the watch-dog of the State.

To reduce pollution of the southern end of Lake Michigan the states of Indiana and Illinois had jointly obtained injunctions against industrial polluters resulting in a clean up costing industry $11,000,000.

As a means of waste treatment with recovery of saleable products the report cited as outstanding the development of wool grease recovery from wool scouring wastes by heavy chlorination. which involves the use of hypochlorite to the extent of 33,000 lbs. of available chlorine per million gallons of waste (see "Wool Scouring Wastes Treated by New Chemical Process," *W. & S. Wks.*, Dec. 1946).

While chemical treatment of sewage is on the wane due to scarcity of chemicals and cost, since 1943 chlorination has been extended to an additional 200 sewage plants.

Concerning sludge disposal the report directs attention to the value of pre-heating the sludge input to digesters. As far as sludge for fertilizer is concerned the report offers no encouragement in the matter of a profit from the sale of prepared sludge in the fertilizer market. Chicago has constructed sludge lagoons as a fixture and permanent addition to the large Southwest Plant, the lagoon capacity being 110 cu. ft. per capita. Odors and flies are controlled by motor truck sprayers. The report also comments on the interesting development of digested sludge disposal into waterways which are capable of assimilating this nonpathogenic sludge —notably at Portland, Ore. and Boston.



Comm. Chm'm.
Langdon Pearse
San. Engr.
San. Dist. Chi.
Chicago, Ill.

Phila. Disposal
M. B. Tark
San. Engr.
Link Belt Co.
Phila., Pa.

Pertaining to aeration the report comments on the weakness of the turbine type blowers in contrast with the positive displacement type blowers when pressure builds up due to diffuser cloggage or other causes. The report stresses the importance of adequate air cleaning to preclude clogging of diffuser units and also the importance of maintaining low rates of air put through to effect longer life of plates or tubes.

Commenting on the question of the dual disposal of garbage and sewage the report states that 8 to 10 cu. ft. of digester capacity per capita must be provided if garbage solids are to be digested with sewage solids.

New Officers

The following were announced as the Division Officers for the year 1948.

Chairman
Harry M. Freeburn, Chief Engr. Philadelphia Suburban Water Co., Bryn Mawr, Pa.

Secretary
John H. O'Neill, Chief Engr. Louisiana State Dept. of Health, New Orleans, La.

The new member elected to the Division's five member Executive Committee is Frank W. Jones, Chief Chemist, Haven & Emerson, Engrs., Cleveland, Ohio. Other members of the committee are R. F. Goudey (California) and A. H. Weiters (Iowa), in addition to the Chairman and Secretary.

Dr. A. R. Jacobson Joins N.Y.U. Sanitary Eng. Staff

Dr. A. R. Jacobson has been appointed Assistant Professor of Sanitary Chemistry in the Dept. of Civil Engineering at New York University.

Dr. Jacobson had extensive experience in water and sewage chemistry in the Navy, which he joined in 1945, handling military problems on water purification, sewage treatment, rodent control, food inspection, etc. During the past year he has served with the U. S. Engineer Research and Development Laboratories at Fort Belvoir, supervising research on water supply and treatment problems.

Prior to Navy service, Dr. Jacobson held responsible water purification posts with the North Dakota State Geological Survey, the Univ. of Iowa Water Plant, Kansas City Water Dept., and the Iowa State Hygienic Laboratories.

Dr. Jacobson was awarded a Ph. D. by Univ. of Iowa in 1941.

Prof. Malcolm Dies

Dr. William Lindsay Malcolm, Director of the School of Civil Engineering, Cornell University,

since 1938, died on January 18 following a heart attack. A native of Mitchell, Ont., Dr. Malcolm came to Cornell from Queens University, Kingston, Ont., where he had served from 1907 as assistant professor of civil engineering and professor of municipal engineering.

Professor Malcolm served in the first World War with the Canadian Army Engineers and attained the rank of Lieutenant Colonel. He received the Master of Arts degree at Queens in 1905, a B.S. in civil engineering in 1907, and a Ph.D. in 1937 from Cornell.

Professor Malcolm was a member of a number of honorary and professional fraternities, as well as the N.Y.S.W.W.A., Canadian Inst. of Sewage and Sanitation, A.W.W.A., and a number of other technical organizations.

A. B. Uzzle City Eng. Canton, N. C.

Archie B. Uzzle, Jr., who has been assistant superintendent of the Raleigh, N. C. water department and an employee of that department for 20 years, has resigned to become city engineer of Canton, N. C.

Mr. Uzzle has been a contributor to these pages.

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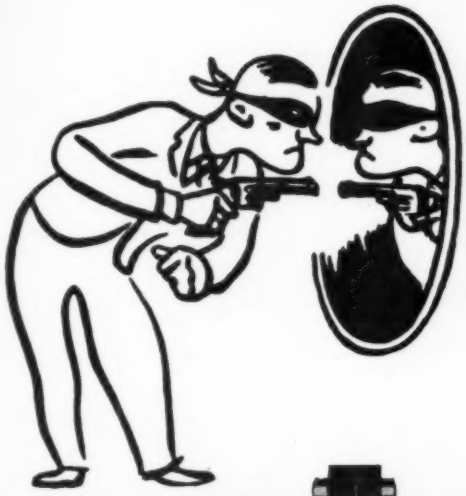

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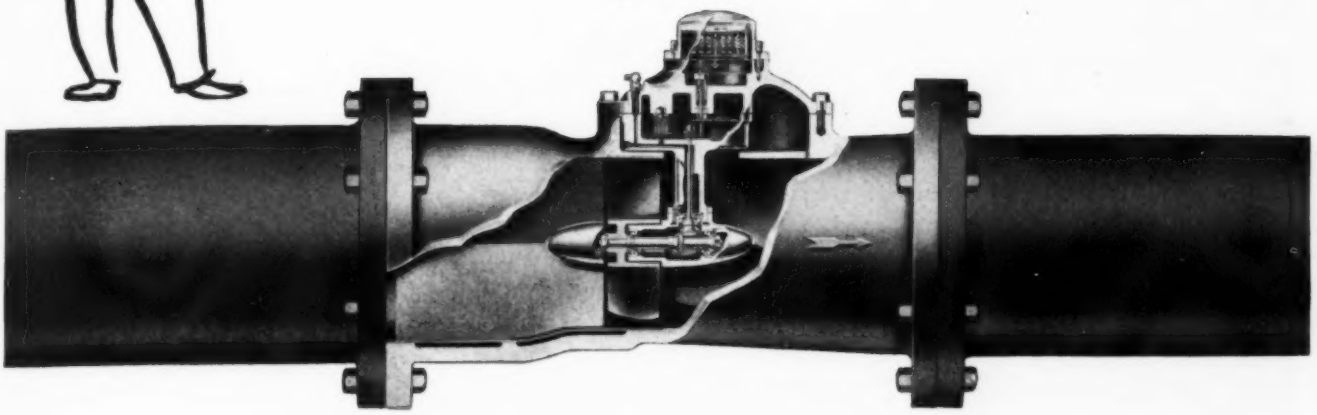

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MEETINGS SCHEDULED

APR. 1-2—SYRACUSE, N. Y. (Hotel Syracuse)
New York Section A.W.W.A. (Spring Meeting). Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York, N.Y.

APR. 2-4—GLOBE, ARIZ.
Arizona Section A.W.W.A. Sec'y, G. W. Marx, Director, San. Eng., State Dept. Health, Capitol Bldg., Phoenix, Arizona.

APR. 5-8—ST. LOUIS, MO. (Jefferson Hotel)
National Association of Corrosion Engineers. Exec.-Sec'y., A. B. Campbell, Southern Standard Building, Houston, Texas.

APR. 7-9—PITTSBURGH, PA. (Wm. Penn Hotel)
American Society of Civil Engineers. Asst. Sec'y, Allen Wagner, 33 West 39th St., New York 18, N.Y.

APR. 8—LIVINGSTON, MONT. (City Auditorium)
Montana Sewage Works Association. Sec'y-Treas., H. B. Foote, State Department of Health, Helena, Mont.

APR. 8-14—SANTIAGO, CHILE (Univ. of Chile)
First Inter-American Sanitary Eng. Congress. Act. Sec'y, Donald L. Snow, 2001 Connecticut Ave., N.W., Washington 8, D.C.

APR. 9-10—LIVINGSTON, MONT. (Hotel Murray) (Tech Sessions, Masonic Temple)
Montana Section A.W.W.A. Sec'y, C. W. Grinck, San. Eng. Div., State Board of Health, Helena, Mont.

APR. 12-14—FAYETTEVILLE, ARK. (Univ. of Arkansas Campus)
Arkansas Water & Sewage Conference (17th Annual Meeting). Sec'y, Prof. Harrison Hale, 118 Chemistry Bldg., Fayetteville, Ark.

APR. 12-14—NIAGARA FALLS, ONT. (General Brock Hotel)
Canadian Section A.W.W.A. Sec'y, A. E. Berry, Ontario Dept. of Health, Parliament Bldgs., Toronto 2, Ont.

APR. 15-16—CHICAGO, ILL. (Congress Hotel)
Illinois Section A.W.W.A. Sec'y, Carl N. Brown, U. S. Pipe & Foundry Co., 122 S. Michigan Ave., Chicago 3, Ill.

APR. 16—PATERSON, N. J. (Y.M.C.A.)
North Jersey Water Conference. (Final Dinner Meeting) Sec'y, E. Walasyk, 299 Park St., Hackensack, N.J.

APR. 21-23—WEST LAFAYETTE, IND. (Purdue Union Building)
Indiana Section A.W.W.A. Sec'y, Charles H. Bechert, 140 N. Senate Ave., Indianapolis, Ind.

APR. 22—LINCOLN, NEB. (Hotel not selected)
Nebraska Section A.W.W.A. Sec'y-Treas., C. L. Fisher, Deputy City Engr., City Hall, Lincoln, Neb.

MAY 3-7—ATLANTIC CITY, N. J. (Convention Hall)
American Water Works Association (Annual Meeting). Hotels—Ambassador, Chelsea and Ritz Carlton. Exec.-Sec'y, Harry E. Jordan, 500 Fifth Ave., New York, N.Y.

MAY 12—MARLBOROUGH, MASS. (Marlborough Country Club)
New England Sewage Works Association. Sec'y-Treas., Walter E. Merrill, 511A State House, Boston, Mass.

MAY 12-15—BOISE, IDAHO (Hotel not selected)
Pacific Northwest Section, A.W.W.A., Sec'y, Prof. Fred Merryfield, Oregon State College, Corvallis, Ore.

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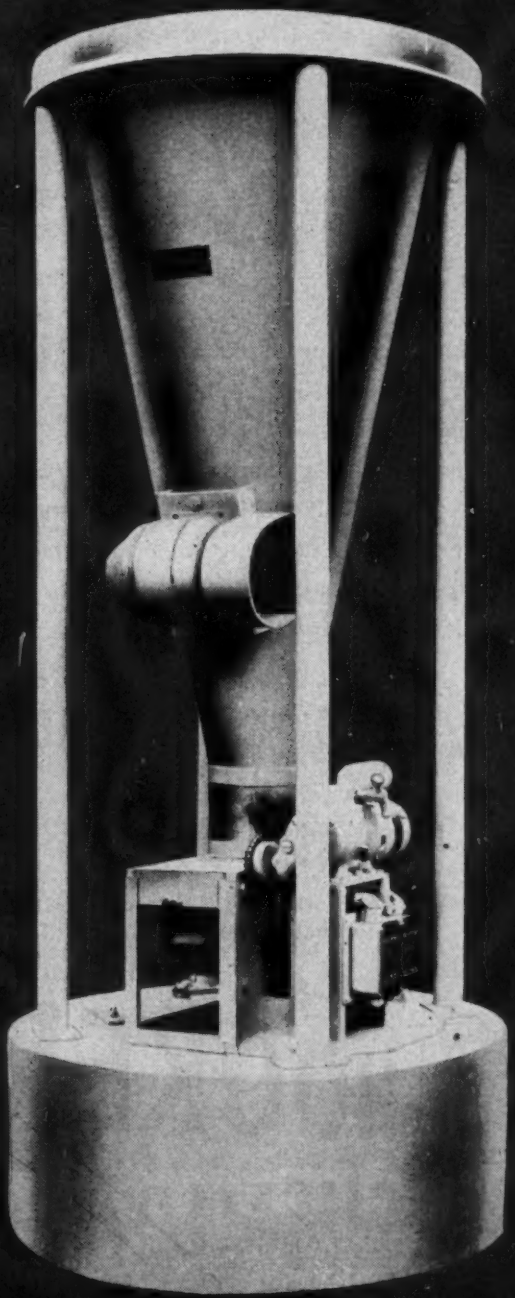

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MEETINGS SCHEDULED

JUNE 4-5—NIAGARA FALLS, N.Y. (Hotel Niagara)
New York State Sewage Works Association. Sec'y, A. F. Dappert, State Dept. of Health, Albany 1, N.Y.

JUNE 7-11—CHAPEL HILL, N.C. (University of North Carolina)
North Carolina Waterworks Operators' Association. Sec'y-Treas., Max D. Saunders, P. O. Box 1126, 23 Oakwood Drive, Chapel Hill, N. C.

JUNE 18-19—MILWAUKEE, WISC. (Schroeder Hotel)
Central States Sewage Works Association. Sec'y-Treas., Paul W. Reed, 1098 W. Michigan St., Indianapolis, Ind.

JUNE 23-25—DAYTON, OHIO (Dayton-Biltmore Hotel)
Ohio Conference on Sewage Treatment. Sec'y-Treas., G. A. Hall, State Dept. Health, State Dept. Health Bldg., Columbus 15, Ohio.

AUG. 23-25—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Association. Sec'y-Treas., I. M. Glace, 1001 Front St., Harrisburg, Pa.

AUG. 25-27—STATE COLLEGE, PA. (Nittany Lion Inn)
Pennsylvania Sewage & Industrial Wastes Association. Sec'y-Treas., Bernard S. Bush, Kirby Health Center, Wilkes-Barre, Pa.

SEPT. 1-2—WINNIPEG, CAN. (Royal Alexandria Hotel)
Minnesota Section A.W.W.A. Sec'y, R. M. Finch, 416 Flour Exchange, Minneapolis, Minn.

SEPT. Date not set—MINOT, NO. DAK.
North Dakota Water & Sewage Works Conference. (20th Annual Convention). Sec'y-Treas., Jerome H. Svore, State Health Dept., Bismarck, N. Dak.

SEPT. 14-17—NEW YORK, N. Y. (Hotel Pennsylvania)
New England Water Works Association. Sec'y, Joseph C. Knox, 609 Statler Bldg., Boston, Mass.

SEPT. 22-24—FLINT, MICH. (Hotel Durant)
Michigan Section A.W.W.A. Sec'y, Raymond J. Faust, State Dept. of Health, Lansing, Mich.

OCT. 7-8—MANSFIELD, OHIO
Ohio Section A.W.W.A. Sec'y, F. P. Fischer, 812 Perry Payne Bldg., Cleveland 3, Ohio.

OCT. 10-13—GALVESTON, TEXAS (Buccaneer Hotel)
Southwest Section A.W.W.A. Sec'-Treas., L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

OCT. 13-15—ATLANTIC CITY, N. J. (Haddon Hall)
Pennsylvania Water Works Association (52nd Annual Meeting). Sec'y, E. R. Hannum, P. O. Box 315, Windber, Pa.

OCT. 18-21—DETROIT, MICH. (Hotel Statler)
Federation of Sewage Works Associations. Sec'y-Treas., W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.

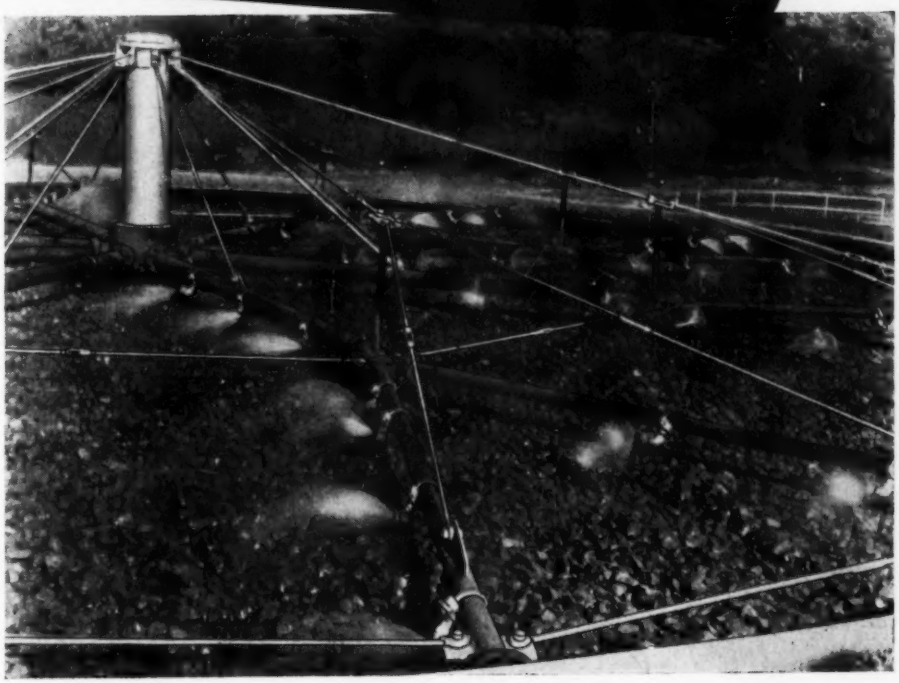
OCT. 27-29—RIVERSIDE, CALIF.
California Section A.W.W.A. Sec'y, H. C. Medbery, Water Department, 425 Mason St., San Francisco, Calif.

NOV. 4-6—ATLANTIC CITY, N.J. (Madison Hotel)
New Jersey Section A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

STOP POLLUTION!

Specify

YEOMANS "Aero-Filter"



The Yeomans "Aero-Filter," a high capacity biological filter for sewage purification, utilizes rain drop distribution without recirculation for dilution purposes.

Over 100 successful installations are establishing extraordinary records of efficient performance, with emphasis on these advantages—

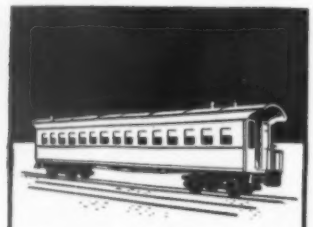
- **pollution-free effluents**
- **absence of odors and flies**
- **year-'round ice-free operation**
- **attractive modern appearance**
- **low first cost**
- **exceptionally low operating cost**
- **compact size of filter**

Yeomans "Aero-Filter" can be tailored to fit any requirements—from small units up to large treatment works. Accurate cost estimates and complete engineering data on an "Aero-Filter" unit for your own requirements can be easily obtained. Write us, requesting Bulletin.

YEOMANS BROTHERS COMPANY, 1423 NORTH DAYTON ST., CHICAGO 22, ILLINOIS

YEOMANS PUMPS · GIVE YEOMAN SERVICE ·

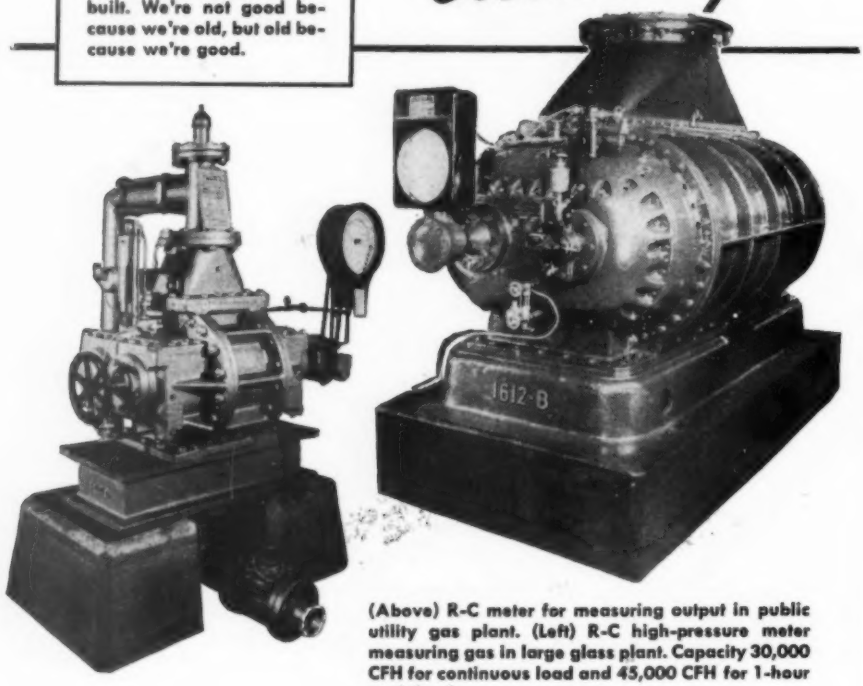
Yeomans Brothers Company



George M. Pullman's first sleeping car went into service in 1859, five years after the first Roots Blower was built. We're not good because we're old, but old because we're good.

Measure

INPUT OR OUTPUT WITH "CASH REGISTER" *Accuracy*



(Above) R-C meter for measuring output in public utility gas plant. (Left) R-C high-pressure meter measuring gas in large glass plant. Capacity 30,000 CFH for continuous load and 45,000 CFH for 1-hour peak load.

Wherever gas needs to be measured . . . for buying, selling or processing . . . you get unfailing accuracy from R-C Positive Displacement Meters. The reasons are:

1. Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture or impurities.
2. Accuracy does not depend on uncontrollable factors.
3. Accuracy is not subject to adjustment of meter or recorder by operators.
4. Accuracy is not affected by reasonable overloads.
5. Accuracy is permanent because measuring chambers are surrounded by precision-machined, cast-iron surfaces.

The wide use of R-C Meters by public utilities, producers, industrial users and processors is the best evidence of satisfactory performance. For details, ask for Bulletin 40-B-14 or write us about your specific problem.

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* * ONE OF THE DRESSER INDUSTRIES * *

Here and There with Doc Symons

H.T.M.A. — And before I get back to the funny stuff (I hope), I must tell you how once again the Symons' ego was restored to near normal size. As some of you know, for a gag, at conventions I wear a lapel label which is cut from the top of this column (without the picture, of course). At the recent N.Y.S.S.W.A. in New York I was so bedecked and talking to Dean Gordon M. Fair (Harvard Graduate School) and Rol Simpson (Gilbert Associates, Reading, Pa.) and Dean Fair looked at the lapel label and said "What the devil is that"—Hmmm! So he's the one who doesn't read this column—

* * *

As I write this the first view of my front lawn in more than seven weeks reminds me of the snows of Buffalo and my college days in Wisconsin.—And thinking of Wisconsin, I wonder if George and Isabelle Martin of the Green Bay Metropolitan Sanitary District Martins, could arrange to have some of that wonderful Wisconsin aged cheese sent to me—C.O.D. of course.

* * *

At the N.Y. Section Annual Midwinter Luncheon E. A. (Siggie) (Nuchar) Sigworth was handing out these cards.

> ***Why be difficult?***
>
> WITH A LITTLE MORE EFFORT
> YOU CAN BE IMPOSSIBLE!

No doubt you can think of times when you wish you could hand some obstreperous individual one of these cards.—If you'd like a

Engineering Facts about

Johns-Manville TRANSITE PRESSURE PIPE

*Winnipeg: A case history**

IN 1932 the city of Winnipeg, Manitoba, made its initial installation of Transite Pressure Pipe. A portion of the installation consisted of an 18″ line. Recently this pipe was subjected to a series of field and laboratory tests to determine its condition after 14 years of service, which had included exposure to an extremely corrosive soil.

Pitometer Flow Test

Before the pipe was removed from the line for the laboratory tests which were to follow, its flow capacity was checked. The Pitometer Company, Inc., New York, was selected to conduct these field tests. Velocities ranged from 1.1 to 1.9 feet per second and readings were made at 30-second intervals. During each test, the velocity was held constant. Results were summarized by the Pitometer Company as follows:

Assembly of pipe and coupling being removed from the line for laboratory tests.

"The high value of C-140, which we believe is a reliable index of the present capacity of the pipe tested, shows that there has been little if any loss in capacity since 1932 when the pipe was laid."

Readings being recorded during Pitometer flow tests on the line.

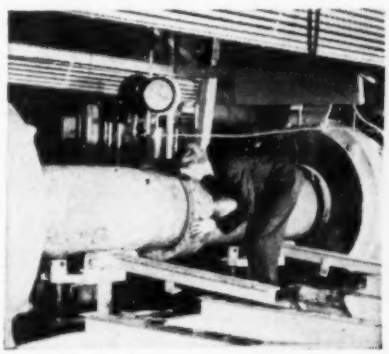
Soil Conditions

The soil in which this Transite installation was made was known to be destructive to water pipe. Analysis showed the presence of certain soluble salts, which, when dissolved by ground water, became highly corrosive.

It was desired, therefore, to determine how well the Transite line had withstood these severely corrosive conditions and thereby to provide a basis for gauging its life expectancy. To do this, a series of physical tests were made, using the sections of pipe which had been removed from the line for the purpose. The most significant of the tests conducted on the pipe were the hydrostatic pressure tests.

Hydrostatic Pressure Tests

In order to simulate field conditions as closely as possible, an assembly consisting of portions of two lengths of pipe joined by a Simplex Coupling with rubber rings and sleeve intact was tested. The complete assembly was placed in a hydrostatic testing machine and the water pressure was raised to 260 pounds per square inch. This was the original test pressure to which this pipe had been subjected at the factory and 4 times the normal working pressure of the line.



Assembly of pipe and coupling undergoing hydrostatic pressure test.

Pressure was held at 260 pounds while observers closely examined the coupling for leakage. No leakage occurred. The rubber rings, undisturbed and in their original position, functioned as well as when the pipe had been placed in service 14 years previously. Subsequent careful inspection and tests confirmed that the rubber rings removed from this Transite line were free from any signs of deterioration.

Specimens of the Winnipeg pipe were also subjected to other laboratory tests. Crushing tests showed that its strength compared favorably with that of Transite Pressure Pipe as manufactured today. A corporation stop pull-out test provided further verification that the strength of this pipe was in no way impaired.

Summary

The above series of tests provided conclusive evidence that the strength, flow capacity and other physical characteristics of the Winnipeg pipe were unimpaired after 14 years' service under severe conditions. Further, as summarized in the original report, they demonstrated that "on the basis of the performance rendered to date, it is reasonable to anticipate a life-expectancy of many times that already obtained."

* *A copy of the detailed performance report on this Transite Pipe installation is available on request. Address Johns-Manville, Box 290, New York 16, N. Y.*

JOHNS-MANVILLE JM PRODUCTS

couple, just fill in a Reader Service Card with the key number—HT3.

* * *

Do you remember when I quoted the McWane Pipe Puzzle about "How fast would a squirrel have to run from one end of his cage to the other in order that his head would be sticking out of both ends at the same time?" McWane said it was impossible, Sam Newkirk said at sixteen times a second, it would appear as though the squirrel's head was sticking out of both ends at the same time; "Bill" Piatt of Durham, N.C., said the answer was infinity; "Bill" Lang of Standard Oil Development Co. wondered if it could be a two headed squirrel; but I think that L. E. (Lindy) Harper of the Omega Machine Harpers has the proper answer, to wit:

"All he has to do is make the trip from one end of the cage to the other in twelve hours or twenty-four hours, or in a week, or a month, or a year, depending on whether you want him to stick his head out of the other end at the same time by the clock, of the day, or week, or month, or year, etc.—If you had said simultaneously, that would be different."

* * *

Many of you have probably seen Linn Enslow smoke his tobacco in "pipe paper." And you've probably seen me using those same papers to clean eye-glasses.—Do a good job, too.—Well, now I've found something newer in eyeglass cleaners. They're known as "Sight-Savers"; are thin sheets of paper, impregnated with Silicone; and are manufactured by Dow-Corning Co. These papers leave a very, very, very, thin film of silicone on the glass to protect the lens and by virtue of its negative electrical charge keep lint particles away.

My friend, Tom Powers, of Dow Chemical Co. sent them to me, and Enslow's pipe papers are safe now from my marauding fingers.

* * *

In the January issue of the *A.W.W.A. Journal*, the editors requested that readers write to them sending either brickbats or bouquets. Now I read their stuff and more than once I've been tempted to write them to say "I wish I'd written that"—but then I don't owe them a letter.

* * *

Water Works Romance No. 6. In the fall of 1936, the Roanoke Water Works Co., then privately owned, was in the throes of a valuation case for rate making purposes. Engineers for the company were Alvord, Burdick and Howson, and Whitman, Requardt and Associates. Lawyers for the company had a secretary named Mary Claiborne, a qualified attorney in Virginia. The hearings on the case were held in Richmond before the state Corporation Commission and lasted for months. The engineers sent a young fellow by the name of Roy Ritter down to Richmond to do the slide rule work.

Well, you just can't throw two young unattached people together constantly, without something happening, even if their attention is directed to such boring things as rate structures. Of course every one connected with the case knew what was happening before Roy and Mary did. It took them a year to find out and get married. When I met Mary last November, all I could say to Roy was, "What detained you, Bud?"

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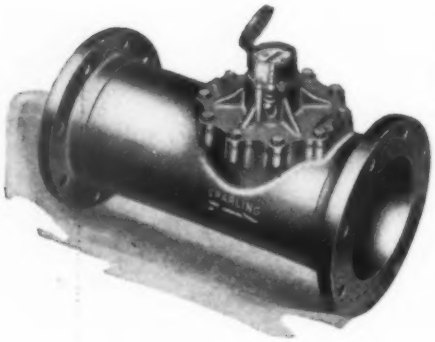
Have Given
SERVICE and SATISFACTION
for 29 Years!



TUBE METERS
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SADDLE Mounted
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COMPOUNDS
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Every Sparling Meter Is a COMPLETE Totalizing Unit

INSTALL the Sparling Tube Meter as though it were a length of the main line itself. Turn on the flow. Read the Totalizer. It is as simple as that, the Sparling way! Accuracy within 2 per cent over a wide range of flows.

Whenever it suits you, add an Indicator-Totalizer-Recorder-Pedestal, Wall or Panel Mounted—24-hour, 7-day or 60-day charts—located near the meter or where you will.

Also controls for auto-metered chemical feeds.

The new Bulletin 310 comes at your request.

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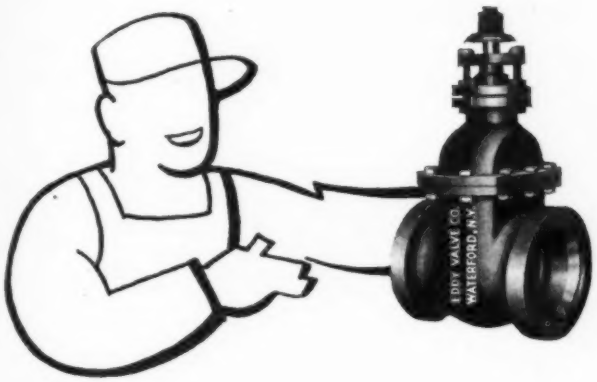


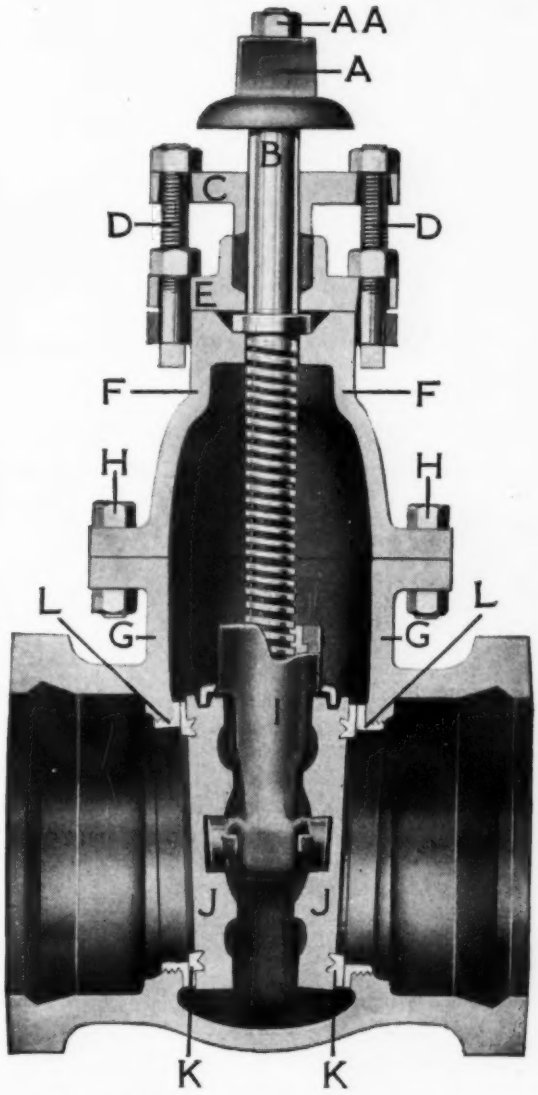
THIS EDDY TAPER SEAT VALVE . . . . Has Only 3 Moving Parts!

The two Gates and the Ball are the only three parts that are moved by the stem in the Eddy Taper Seat Double Gate Valve. For simplicity, easy, sure operation, durability, high-quality workmanship and performance, the Eddy Valve ranks second to none.

For 99 years the Eddy Valve Company has successfully met the exacting requirements of discriminating buyers of valves. When you buy Eddy, you have the best.

"Eddy for Long Service"

Write today for completely descriptive literature.



AA Stem Hold-down Nut
A Stem Operating Nut
B Stem
C Follower
D Follower Bolts
E Stuffing Box
F Cover
G Body
H Body and Cover Bolts
I Ball
J Gate
K Gate Ring
L Seat Ring

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Waterford, New York

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H. B. Hommon
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USPHS,
Retired
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With the approaching A.W.W.A. convention in Atlantic City, N.J., I'm reminded that I still have some pictures from the San Francisco meetings. Here is a strip that I didn't get in the reports of those meetings.—And I have another strip you've all been waiting for—see it next month.

* * *

One of my readers, who shall be nameless, because he asked it (and also because I can't make out his signature) sent me this letter which his water department had received.—

"Bd. of Health, Dept. of Water Supply: Dear Sirs:—What is wrong with the water in the vicinity of west — Ave.? Dozens of people complain of having to take more laxatives now and in the past few years than they did ever before. Rectal troubles are more numerous. This is no joke. If some chemical to kill germs is being employed in the water, cannot something else be used to kill water bacteria, but not something that causes troubles internally and constipation? Has it anything to do with the new pipe on — St. and — Ave.? Truly yours, Residents of the Neighborhood."

Now there's a case for some good public relations. Maybe the residents hadn't thought that some of them had become thirty-five about the time that pipe was laid and now needed something spelled backwards.

* * *

E. L. Filby, the philatelist (stamps collector to you and me) of Black and Veatch, Cons. Engrs., of Kansas City, sent me a newspaper clipping from the Chicago, Ill., News with an item titled, "Lady 'Garbage Loader' Puts Alderman in Dumps." It turns out that she is a clerk in the department of streets and electricity.—What's in a Name —?

* * *

I knew if I kept mentioning "the lexicographer's easy chair" that someone would ask me for the source of some word. And I was right — Lou Frazza (The Transite Pipe Mgr. in New Jersey) wants to know: "Why do plumbers (particularly in the N. Y. Metropolitan area) call cast iron water pipe, 'Corporation Pipe'" Anyone know?

* * *

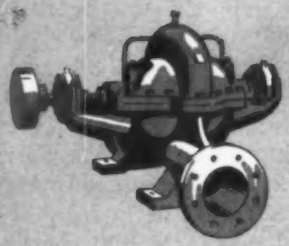
Oldest Subscriber Dies—A year ago I was quite pleased to receive a letter from J. W. Dappert, of Taylorville, Ill. He was, he believed, our oldest subscriber. Not

We'll help you engineer
the correct *pump to your application*

VERTICALS

VERTICAL DEEP WELL AND CLOSE-COUPLED TURBINE PUMPS—HYDRO-FOIL PROPELLER AND MIXED FLOW PUMPS—MINE PUMPS—HI-LIFT PUMPS—UNDERWRITERS' APPROVED VERTICAL FIRE PUMPS—DOMESTIC FIRE SYSTEMS.

PEERLESS VERTICAL TURBINE PUMP



PEERLESS TYPE A HORIZONTAL PUMP

HORIZONTALS

GENERAL PURPOSE PUMPS—BOILER FEED PUMPS—SEWAGE PUMPS—CHEMICAL PUMPS—UNDERWRITERS' APPROVED FIRE PUMPS—REFINERY AND PROCESS PUMPS.

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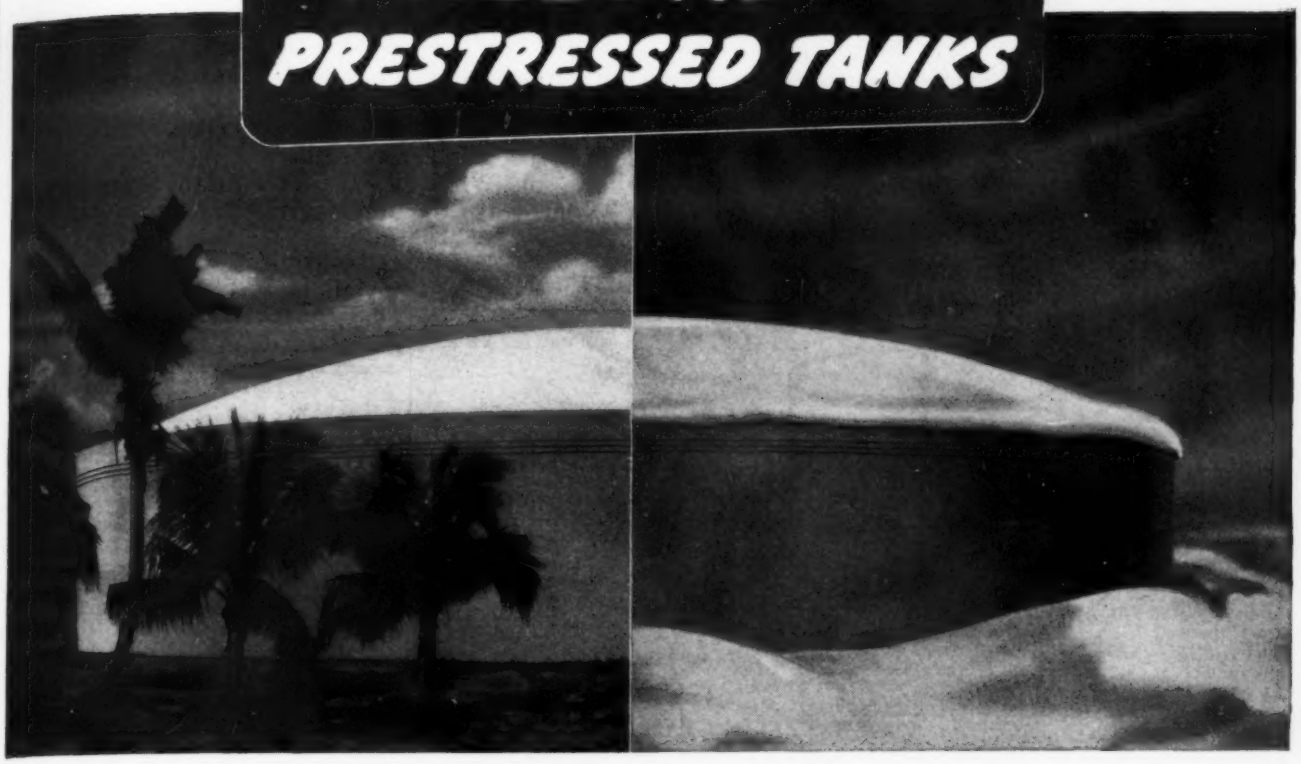
PRELOAD PRESTRESSED TANKS



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Internal corrosion, and external deterioration due to severe weather conditions, are the principal causes of repair and rehabilitation jobs on metal tanks or tanks designed and built by conventional methods of reinforced concrete construction.

PRELOAD PRESTRESSED CONSTRUCTION, utilizing a homogenous, smooth, dense interior and exterior gunite surface, offers no exposed metallic areas where corrosive action can take place. The balanced stresses attained by carrying the load with PRELOAD PRESTRESSING cannot cause cracks due to internal strain. The exterior finish is proof against spalling and other weather hazards.

In the summer heat of Miami or the winter cold of Halifax, from the torrid heat of Colombia to the extreme cold of Canada, PRELOAD TANKS have long demonstrated their ability to stand up under any weather conditions.

Built with locally available materials and labor, and adaptable to creative design techniques which will fit into residential environments, PRELOAD TANKS offer substantial economies in first cost and long-term maintenance costs. Specify PRELOAD TANKS for municipal or for industrial water storage; storage of oil and other bulk liquids; and for use in sewage disposal plants.

Send for Bulletin

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Designers and Builders of Prestressed Concrete Storage Tanks and Pressure Pipe
Prestressed Concrete Bridges and Cement Lining of Pipe in Place

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Preload Pacific Corporation
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Montreal—Toronto—Halifax

only was he 87 years old, but he had been a subscriber to *Water & Sewage Works* ever since the Gillette Publishing Co. began to publish it. At 87 he was still making surveys, still keeping his detailed diary, and still reading our magazine. He had other interests in this field, in particular a son, A. F. Dappert, Prin. San. Engr., N.Y. State Dept. of Health, Albany, N.Y.

Last December, Mr. Dappert, Sr., died at his home in Taylorville, Ill.; a few short months before he had been making surveys.

I wish I had known the old gentleman.

* * *

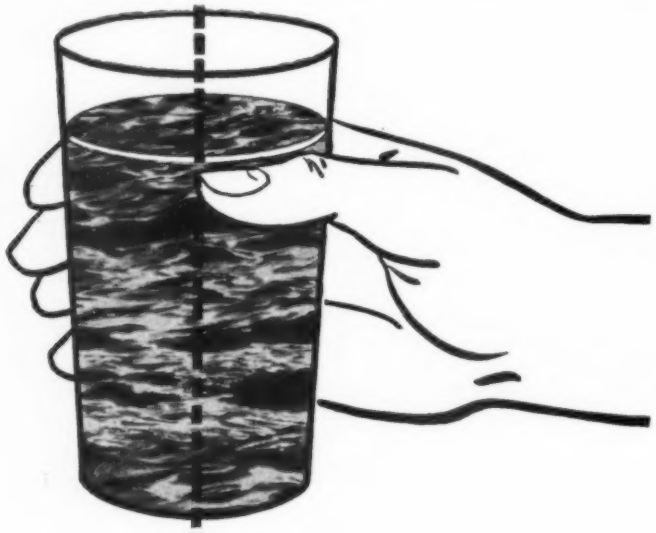
Well, folks, I got four requests to run a contest, one warning that I'd be sorry, while another said I'd probably do it whether or not I received any requests. Two of the letters contained puzzles. Now I didn't say that I'd run mathematical puzzles. Just to be different my contests will be Who, What, When, Where, or Why? And the first one has already appeared twice. To wit: Who are the Maxwell Twins?

Now in these contests, persons who are in any way connected with the contest item are not eligible. The first correct answer received (the post mark counts) will receive a prize.

O.K. WHO are the Maxwell Twins?

* * *

Just a reminder—The April issue this year will carry the Reference and Data Section — But don't start throwing out past issues, it takes at least three of these issues to hold all of the material now available. — V.T.Y., Doc.



EITHER IT'S SAFE . . . or it isn't!

You can't draw a dividing line in water to separate the safe portion from the unsafe. Water must be all safe . . . all the time! That's why SOLVAY Liquid Chlorine is being used more and more widely to purify water . . . and to avoid the spreading of dangerous bacteria. For your water purification, choose the quality product—SOLVAY Liquid Chlorine. Available in cylinders, tank cars and ton containers.

For Water Softening . . .
specify SOLVAY Soda Ash.

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For Water Conditioning

SOLVAY LIQUID CHLORINE
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MANUFACTURERS' and EQUIPMENT NEWS

300

Breathing Equipment

The Safety Equipment Division of Scott Aviation Corp., Lancaster, N. Y., has announced a new model self-contained breathing

apparatus. This is designated as the Senior Sling Pak, Model 6000-B4.

Light and snug fitting, the new Scott Air-Pak permits entry into unbreathable atmospheres through extremely small manholes or doors and provides a minimum of 15 minute use at extreme exertion. A spare cylinder is provided.

Further information may be obtained by mailing a Reader Service card containing the above key number.

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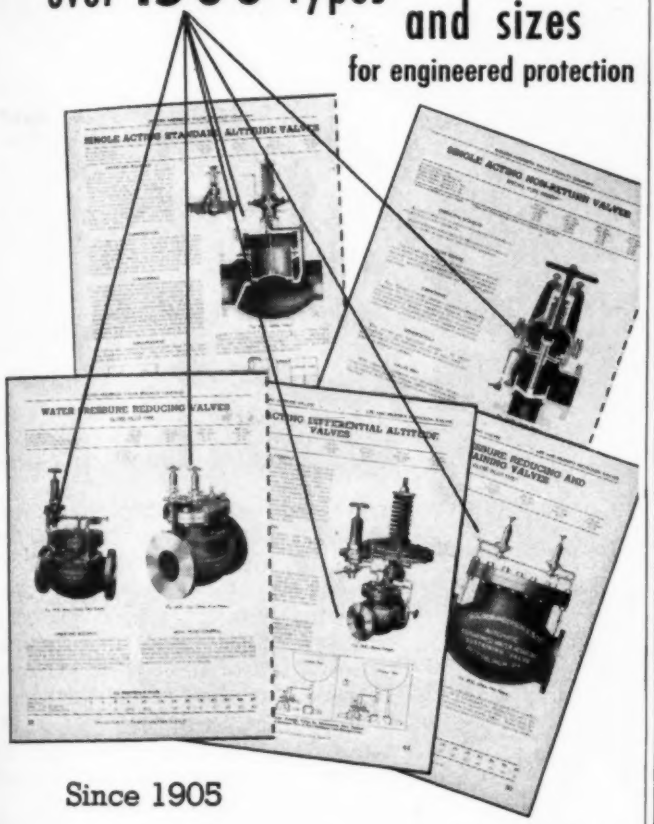
over 1500 types and sizes for engineered protection



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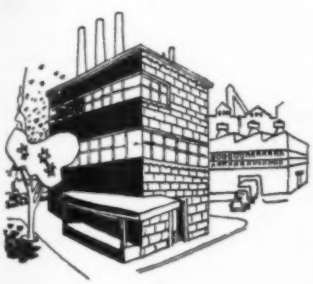

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M&H VALVES HYDRANTS

M & H Flap Valve

VALVES: A.W.W.A. type iron body, bronze mounted with double-disc paralell seat or solid wedge type. Non-rising stem, outside screw and yoke, or with sliding stem and lever. Also furnished hydraulically operated. Square bottom type operates in any position. All rugged and dependable, made of best material with highest quality workmanship. *Hydraulically Operated:* For remote control of operation and for quicker, easier opening or closing. Can be supplied in any of the standard sizes of M & H A.W.W.A. gate valves, either high or low pressure.

HYDRANTS: Standard A.W.W.A. type approved by Underwriters and Factory Mutuals. Dry top, revolving head, easy to lubricate. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway. SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem.

M & H Shear Gate

Write for Catalog No. 34

M & H PRODUCTS INCLUDE

FIRE HYDRANTS	SHEAR GATES
GATE VALVES	MUD VALVES
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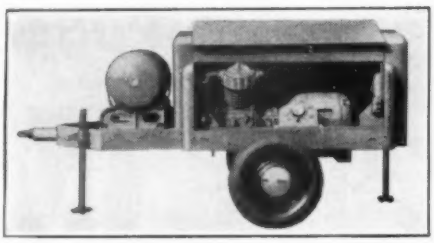
TAPPING SLEEVES	FLANGE AND FLARE FITTINGS
CHECK VALVES	FLANGED FITTINGS
FLOOR STANDS	B & S FITTINGS
EXTENSION STEMS	CUTTING-IN TEES

M & H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

301

Portable Compressor



The Davey Compressor Co., Kent, Ohio, has announced a new line of electric portable compressors in 60, 105, 160, 210, and 315 c.f.m. capacities.

Available in skid, 2-wheel trailer, and 4-wheel trailer mountings, the new units are known as Air Chief "Electrics."

Further information on these compressors may be obtained by mailing a Reader Service card with the above key number.

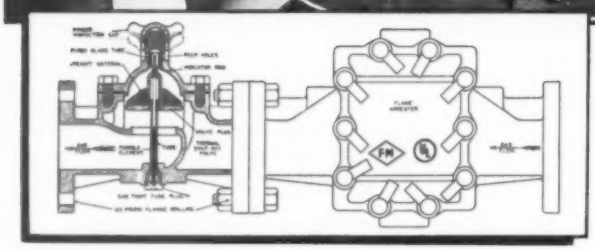


Figure 450 Flame Trap Assembly—Consists of Flame Arrester and Thermally Operated Shut-Off Valve. Installed in straight-pipe-line flow. No expensive fittings necessary. Self-contained, simple and foolproof. Fusible element melts at 200° F. and stops gas flow within 15 seconds. Shut-Off Valve cannot close unless contacted by flame.

Are you taking every precaution for safe operation in your Sewage Treatment Plant? "No Smoking" signs are a routine requirement, but "VAREC" Safety Devices are a "must" wherever any inflammable gases are subject to accidental ignition.

Gas lines in your Sewage Treatment Plant must be completely protected with Flame Traps, Flame Arresters, Flame Checks and other Safety Devices that stop the propagation of flame. The devices you install should be of large enough size and great enough capacity so that you do not limit the required flow of gas. "VAREC" Safety Devices are designed to give you maximum flow capacity for their size and yet they give you positive protection for arresting flame.

You can select a unit for a particular protective job very simply with the aid of curves prepared from actual flow tests in the "VAREC" Laboratory. These flow curves for the various size units, illustrated along with complete engineering data in the "VAREC" S-3 Catalog, will be sent to you merely at your request on your letterhead.

5-2

THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA, U.S.A.
"Varec"
NEW YORK 30 Church Street • CLEVELAND 1501 Euclid Ave. • CHICAGO 122 So. Michigan Ave. • TULSA 533 Maye Building • HOUSTON 821A M. & M. Bldg.
Available from Authorized Sewage Equipment Agents throughout U. S. and Canada
Cable: VAREC COMPTON (all codes)

Hardinge Appoints Sales Representatives

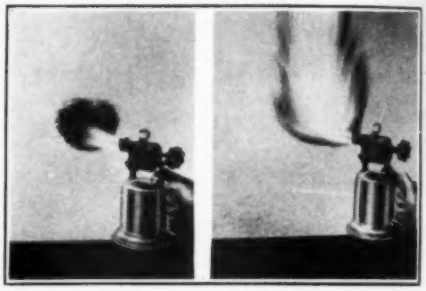
Hardinge Co., Inc., York, Pa., has announced the appointment of Fred Gibbs' Engineering Sales Corp. of Boston, Mass., and the Auto-Filtration Co. of Montreal, Canada, as sales agents for Hardinge automatic backwash rapid sand filters, clarifiers, flocculators, digesters, etc., to the pump and paper industry, water works, and sewage disposal plants in their respective areas.

302

Fire-Retardant Paint

Developed by the Albi Manufacturing Co., Inc., 9 Park Place, New York 7, N.Y., a new fire-retardant paint bids fair to be a mighty weapon against the peril of fire.

Called Albi-"R", this new paint may be applied by spray or brush to interior combustible surfaces. Designed primarily to protect



wood, plywood, fibre insulation boards, etc., under exposure to flame or high heat, the Albi-"R" coating develops into a heavy insulating blanket which prevents the spread of flame and retards penetration of heat to the treated surface. Because of its heat-insulation effect, Albi-"R" can be extended for use on non-combustible surfaces such as plaster, plaster board, and unprotected metals.

It has received favorable tests in many laboratories and is the only fire-retardant coating listed by the Underwriters' Laboratories.

Further information may be obtained by mailing a Reader Service card with the above key number.

Horstman and Dahlstrand Upped at Allis-Chalmers

According to a recent announcement, E. H. Horstman and Hans P. Dahlstrand have been named respectively chief engineer and director of engineering of the Allis-Chalmers steam turbine department.

5 GOOD REASONS

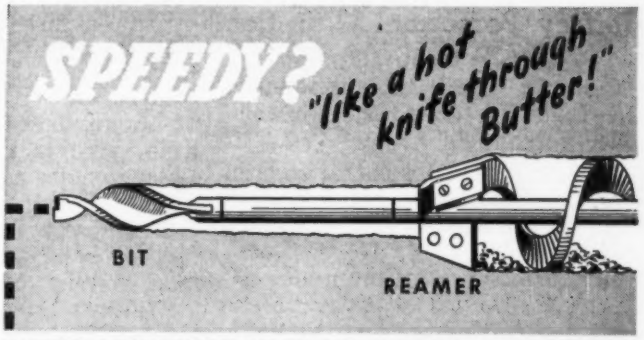
for buying Blaw-Knox Grating

. . . COUNT 'EM!

1. STRONG electroforged construction for easy erection.
2. MAXIMUM OPEN AREA for light and air.
3. EASY TO MAINTAIN . . . paint reaches entire surface.
4. SELF-CLEANING, no sharp corners to clog.
5. SAFE footing at all times with twisted cross bar.

BLAW-KNOX DIVISION
of BLAW-KNOX CO.
2031 Farmers Bank Bldg.
Pittsburgh 22, Pa.

BLAW-KNOX ELECTROFORGED STEEL **GRATING**

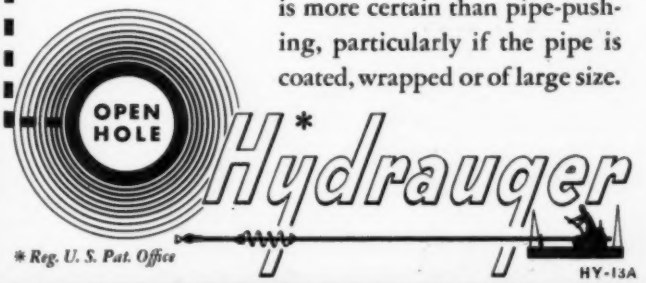


THE LOW COST WAY TO INSTALL ANY PIPE

Write for Catalog No. 8 TODAY!

HYDRAUGER CORP., Ltd.
681 Market Street
San Francisco 5, California

Even the toughest earth formations, like rotten rock, are no obstacle to Hydrauger operations. In fact, Hydrauger has fewer limitations, especially in time and costs, than trenching; and it is more certain than pipe-pushing, particularly if the pipe is coated, wrapped or of large size.



** Reg. U. S. Pat. Office*

HY-13A

EARTH BORING TOOL

*"Every individual connected with water purification or sewage works should subscribe to this publication. I have introduced it to a host of friends in this field"**

Testimonials such as this from subscribers to WATER & SEWAGE WORKS really tell the story. The man who reads and uses the magazine as an aid in his work knows how much it will benefit other workers in the field.

If you are not a subscriber send your order today! The great REFERENCE & DATA issue alone is worth more than the yearly subscription rate.

**Name furnished on request.*

WATER & SEWAGE WORKS
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Chicago 10, Ill.

You may enter my order for ☐ 1 yr. @ $2.00 ☐ 2 yrs. @ $3.00 My title .....
Check enclosed ☐

Address .....

Send bill to..... City ..... Zone..... State.....

Jeffrey Personnel Changes

The Jeffrey Manufacturing Co., Columbus, Ohio, has announced the following changes in branch office personnel.

Howard S. Davies is transferred from the Baltimore office to Chicago as District Manager of the Conveyor Division; H. C. Rockwell, formerly of Columbus, replaces Mr. Davies as District Manager in Baltimore, and Paul M. Hendry succeeds Mr. Rockwell at Columbus.

William K. Myers, formerly of the New York office, succeeds B. L. Lewis, deceased, as District Manager of the Boston office. H. A. Lee of St. Louis has been appointed District Manager of the St. Louis office, replacing F. L. Kolb, who is transferred to the Chicago office as District Manager of the Mining Division.

New sales engineers transferred from the home office to various district offices include Earl J. Woltz to Harlan, Ky., J. R. Brisley to Philadelphia, Norman S. Bell, Jr., to New York, William T. Davis to Houston, Tex., and J. W. St. John from the Pittsburgh to the Cleveland office.

power costs reduced 14%
volume increased 300%
coefficient raised 225%
for
ATLANTA

Before cleaning 17,000 feet of badly tuberculated 30" pipe for the City of Atlanta, a coefficient of less than 60 was established. After cleaning and centrilining the coefficient was raised to over 135, resulting in a power saving of 14% and an increase of 300% in the carrying capacity of the line.

With similar results obtained in the past, is it small wonder that National has served the City of Atlanta since 1906?

Take advantage of National's 40 years of cleaning experience — other leading cities have. No obligation of course!

23

NATIONAL WATER MAIN CLEANING COMPANY
50 CHURCH STREET, NEW YORK 7, N. Y.

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HOUSTON	2518 Grant Street	MONTREAL	2028 Union Avenue
KANSAS CITY	421 BMA Building	VANCOUVER, B. C.	505 West 1st Avenue
LOS ANGELES	448 South Hill Street	WACO	P. O. Box 887
MEMPHIS	822 Dermon Building	WINNIPEG	576 Wall Street
OMAHA	3812 Castellar Street	HAVANA - MAYAGUEZ, PUERTO RICO - BOGOTA	
RICHMOND	210 East Franklin Street	CARACAS	MEXICO CITY

B. Klaussen Named Vice Pres. of Hooker

Hooker Electrochemical Co., Niagara Falls, N. Y., has announced the promotion of Bjarne Klaussen to the position of vice president in charge of production at the Niagara Falls plant.

Mr. Klaussen is a graduate of the University of Oslo and has been a member of the Hooker organization since 1916. In 1940 he was made manager of the Niagara Falls plant and he has been a member of the board of directors since 1942.

303

Top Suction Sump Pump

Gardner-Denver Co. has announced a new top suction sump pump designed to overcome one of the common causes of pump failure, namely breaking of the pump shaft seal because of water pressure.

This new sump pump, known as the VP-4, embodies a new principle of top suction. Light in weight and easy to move from place to place, the pump has many other advantages.

Mail a Reader Service card with the above key number for additional information.

VALVES AND FITTINGS

DEPENDABLE PERFORMANCE SINCE 1901

Iron Body Gate Valves
Iron Body Check Valves
Iron Body O.S.Y. Valves
Iron Comp. Flanges
Iron Flange Unions

"A" TRADE MARK

Brass Pipe Fittings
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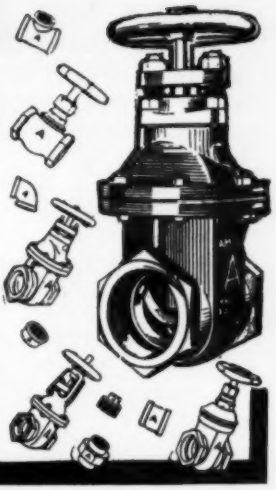
Brass Globe Valves
Brass Check Valves
Brass Radiator Valves
Brass Gas Cocks



AMERICAN VALVE MFG. CO. Coxsackie, N. Y.

N. Y. OFFICE & WAREHOUSE: 37-25 32ND ST., LONG ISLAND CITY 1, N. Y.

LUMETRON

Photoelectric Colorimeter Model 450 for Nessler Tubes

A new photoelectric instrument of high accuracy for the measurement of color and turbidity, as well as for all analytical colorimetric tests in the examination of water and sewage.

- Turbidity tests in terms of APHA (ppm) scale.
- Color tests in terms of APHA (mg Pt) scale.
- Suited for determination of ammonia nitrogen, nitrate, nitrite, and for all other colorimetric tests according to APHA "Standard Methods."
- Operates with all "low form" Nessler tubes 32 mm O.D., 200 mm high. Requires no matched sets of tubes.

LUMETRON Mod. 450 eliminates the uncertainties of visual matching methods. It requires no permanent color standards and furnishes reproducible results independent of individual judgment and of light conditions.

Write for literature to

PHOTOVOLT CORP.
95 Madison Ave. New York 16, N. Y.

Write also for literature on

PHOTOVOLT Line-Operated pH METER

GEOPHONE locates leaks without digging

"Registered in U. S. Patent Office"

When the discs are placed on the ground (as pictured) the Globe Geophone detects by sound the exact location of leaks in water or steam pipes. Acclaimed for its accuracy, the Globe Geophone has become indispensable in Public Works Departments and Industrial Plants throughout the United States.

● MONEY-SAVING

You save the costly expense of extensive surveys, excavating and replacing. The inexpensive Globe Geophone pays for itself many times over in money saved.

● ACCURATE

Operating on the principle of the seismograph, the Globe Geophone is without question the most sensitive and reliable instrument for detecting underground leaks.

Complete Geophone outfit consists of connecting tubes, two Geophone discs, headpiece, and heavy leather-covered carrying case with shoulder strap. **$85**

Pipe Finders . . . $110
Dipping Needles . . . . . $ 20
Pipe Phones . . . $3.70

Globe Phone Mfg. Corp. Reading, Mass., U. S. A. Dept. F

Manufacturers of Geophones Since 1918

The SEWER SCOOTER

(U. S. Patent 2,198,823)

THE ONLY 100% SELF-PROPELLING SEWER CLEANER

THE FLUSHING ACTION IS APPLIED BY COLLAPSING THE SHIELD.

A patented feature

No Preliminary Work— Gets Results in a Hurry

SEWER SCOOTER MODEL A-3, BRONZE

Standard machines stocked 8 inches to 96 inches—For sale, rent or contract.

J. C. FITZGERALD

Box 289-A
Coral Gables 34, Fla.

Cochrane Corp. Marks 85th Anniversary

Cochrane Corp., Philadelphia, manufacturer of water condition and steam handling equipment, celebrates its eighty-fifth continuous year in the power plant equipment field. Predecessor of the company was the Harrison Safety Boiler Works, founded in 1863 to build cast iron boilers constructed of sections held together with tie bolts. In 1880 David Cochrane, foundry and shop foreman, developed the first practical oil separator for cleaning exhaust steam. This made possible the first open feedwater heater system, from which has developed the many products of the company today.

Hennessy Penn Salt's Special Chemicals Sales Mgr.

The Pennsylvania Salt Manufacturing Co. has announced the appointment of William J. Hennessy, Pittsburgh District Sales Mgr., for the Special Chemicals Division of the company.

In his new capacity, Mr. Hennessy will supervise special chemical sales operations in Pittsburgh, Cincinnati, Cleveland, Buffalo and Altoona.

E. W. Scripture of Master Builders Decorated

Dr. Edward W. Scripture, Jr., Vice Pres. in Charge of Research for The Master Builders Co., has been decorated with the "Palmes Academiques" by the French Ambassador, Monsieur Henri Bonnet, on behalf of the French Government.

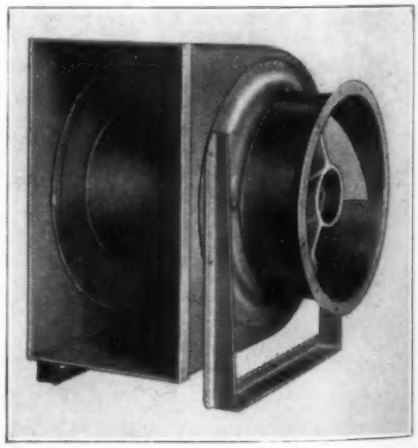
This civilian decoration was presented for services rendered to science and resulted from Dr. Scripture's participation during the war in a scientific congress held in Paris at which he gave a paper on Cement Dispersion. At that time, Dr. Scripture was a Colonel in the U. S. Army Corps of Engineers, having served over three years in the ETO.

The Master Builders' Research Laboratories developed the dispersion principle for Portland cement through use of a derivative of lignin, a development introduced fifteen years ago as Pozzolith.

304

New Sturtevant Axiflo Fans

A new line of axial flow pressure fans has been announced by the Sturtevant Division of Westinghouse Electric Corp. Two basic types of these fans are available, the straight-through type or the convertible elbow type, both furnished with either the three-bladed aluminum alloy wheel or the eight-bladed steel wheel.



SINGLE AND DOUBLE LID

METER BOX COVERS

for every Climate and Condition

Ford Meter Box Covers are made in sizes to fit on meter box barrels or tile from 15" to 36" diameter. They are made with several sizes of lid openings, with inset or overlapping lids, for sidewalk or lawn installations, for light or heavy traffic conditions. For really cold climates double-lid covers are recommended.

All are fitted with the Lifter Worm Lock that effects a tight fit, permits easy opening even when sealed with ice or dirt and makes it easy to lift the lid with the key.

Send for complete Ford Catalog No. 46. It describes Ford Covers and many other useful devices for more efficient metering of water services.

THE FORD METER BOX COMPANY, INC.

FORD

FOR BETTER WATER SERVICES

Wabash, Indiana

Applications of these fans include air conditioning, dust and fume removal, machinery cooling, mechanical draft for combustion, industrial drying and processing, etc.

Sizes vary from 18 to 72 inches, with static pressures from 0 to 3 inches, and displacement from 2,000 to 115,000 cfm.

Further information may be secured by writing for it.

305

Velocity Power Driver

Mine Safety Appliances Co. of Pittsburgh, Pa., has developed a M.S.A. Model B Velocity Power Driver for use in driving anchors in pipe hangers, conduit boxes, structural plate, or concrete. Threaded or headed studs are driven instantaneously.

Heating and ventilating ducts, gas, water, fuel, and sprinkler lines, etc., or any place where structural steel is hung by studs will find a use for this new tool.

Weighing but 4½ lbs., the operation is comparatively silent and is flashless without recoil. The energy is supplied by a small blank cartridge.

"Public Aberrations"

"The Water Department FROWNS on such consumer conduct, Mr. Schlimeel!"

In an 80-foot section, joined with *Tegul*-MINERALEAD, the center was lowered 7 feet while under pressure—and the joints resealed themselves.

The result of this experiment should be welcome news for water engineers who want to avoid digging up lines to repair leaks when terrain goes temperamental.

While important, this isn't *Tegul*-MINERALEAD's *only* advantage. Its ingot form is easier to handle, ship and store. It can't change its correct physical composition, no matter how much jolting it gets between factory and point of use.

And if snow, rain — or even flood, catches it unprotected, you won't have to worry — Dampness — even submerging for days — cannot hurt it. *Tegul*-MINERALEAD is *always* ready to go to work.

It needs no skilled labor, no caulking, no deep bell holes — and *Tegul*-MINERALEAD joints are sturdy, have higher resistance to thermal and mechanical shock and can "take" far more vibration than they'll ever meet in normal service.

Write for more information about *Tegul*-MINERALEAD. At the same time ask us about the HYDE-RO Ring, which replaces jute as packing for bell and spigot joints — saving water and hypochlorite, time and labor — and giving dry joints when repairs are to be made. HYDE-RO Rings speed sterilization and help keep lines in sterile condition. Made for diameters from 4" to 12". Fifty of a size to a carton.

THE Atlas Mineral

PRODUCTS COMPANY OF PENNA.
MERTZTOWN PENNSYLVANIA

*ATLANTA 3, Ga., 452 Spring St., N. W.
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*DETROIT 2, Mich., 2970 W. Grand Blvd.
NEW YORK 16, N. Y., 280 Madison Ave.
PITTSBURGH 27, Pa., 4921 Plymouth Rd.

THE ATLAS MINERAL PRODUCTS CO. OF TEXAS, INC. Box 252, Houston 1, Texas

DALLAS 5, Tex., 3921 Purdue St.
*DENVER 2, Colo., 1921 Blake St.
*HONOLULU 2, Hawaii, U.S.A., P.O. Box 2930
*KANSAS CITY, Mo., 422 B.M.A. Bldg.
*LOS ANGELES 12, Calif., 172 S. Central Ave.
NEW ORLEANS 12, La., 208 Vincent Bldg.
OMAHA, Neb., 423 South 38th Avenue
OKLAHOMA CITY 2, Okla., 708 Braniff Bldg.
*SALT LAKE CITY 11, Utah, 925 S. 6th West St.
SAN FRANCISCO 7, Calif., 115 Townsend St.
*SEATTLE 4, Wash., 1252 First Avenue, S.
ST. LOUIS 8, Mo., 4485 Olive St.
TUPELO, Miss., 517 South Spring St.
*Stock carried at these points

IN CANADA: Atlas Products are manufactured by H. L. BLACHFORD, Limited, 977 Aqueduct Street, Montreal, P. Q., 86 Bloor St. W., Toronto, Ont.

Manufacturers also of HYDE-RO Rings, the complete rubber packing to replace jute... and G-K, the original bituminous Sewer Joint Compound, proof against both acids and alkalis. Reduces or eliminates infiltration and pollution of ground waters.

306

Film on Ion Exchange

The Ion Exchange Products Dept. of American Cyanamid Co. has produced a motion picture film in sound and color on the principles and procedures of ion exchange. The film, entitled "Water, Water Everywhere," is a 16 mm. size, and runs for 23 minutes, showing the many advantages offered by demineralization in various industries.

Prints are available for showing from the Ion Exchange Products Dept., American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.

If you are interested, fill in a Reader Service card with the above key number.

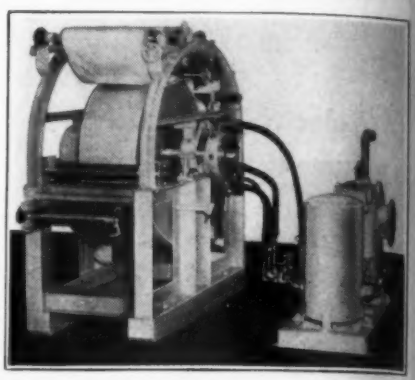
307

Portable Vacuum Filter Available

For pilot plant, or small or temporary production filtering operations, a new rental-purchase plan has been announced by Filtration Engineers Inc., 858 Summer Ave., Newark 4, N. J.

This plan was announced coincident with the introduction of a new FEinc pilot plant rotary vacuum filter with the adaptable FEinc string discharge and washing mechanisms.

Under the plan, the pilot plant filter is placed with the customer on a monthly rental basis and the



fee for the first month is set low to allow for time lost in starting up the process. A later purchase of a FEinc filter for full scale production allows credit for rental of the small portable filter.

This new pilot plant continuous rotary vacuum filter has a three ft. drum diameter and one ft. drum width with approximately 10 sq. ft. drum area. It is made of stainless steel and has all the advantages of the large equipment.

If you are interested in the application of this portable unit for temporary experimentation, fill in a Reader Service card entering the above key number.

308

Westinghouse Industrial Motor

The Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Pa., has announced a new single-phase industrial squirrel cage motor.

This motor, using a life-line capacitor-start and induction-run, is

A Place for Everything—Everything in It's Place!

IT'S EASY TO WORK WITH THE "FLEXIBLE" "CARRY-ALL" TRAILER

Carries Complete Equipment for Rodding Sewers, Cleaning Lines.

Save time—save labor—save stand-by truck with the new "Flexible" "Carry-All" Trailer. A complete sewer cleaning unit on wheels, always ready for instant service. With a place for everything, the "Carry-All" is easy to keep shipshape at all times. Ezy Rod and Reel stand permanently mounted—rods easily reeled directly from trailer. Why not end that bother of loading a truck, when you've got everything you need and always handy on a "Carry-All"?

"Flexible" equipment is sold exclusively through Jobbers. Buy exactly what you need from them. Illustrated Catalog available. Write for your copy.

FLEXIBLE SEWER-ROD EQUIPMENT CO.

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401 Broadway New York 13
147 Hillside Ter. Irvington, N. J
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2011 Central Ave. Memphis, Tenn.
801 E. Excelsoir Blvd., Hopkins, Minn.
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WATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

available in ratings from ¾ to 7½ hp. The motor is of all steel construction and steel frame, and may be obtained for 60, 50, and 25 cycles in single-phase, dual voltage units, or single voltage units of 110/220 volts operating at various speeds.

For further information mail a Reader Service card using the above key number.

309

Cord Extension Reel

Industrial Electrical Works of Omaha, Neb., has announced the development of a unique cord-saver extension reel, called the Port-O-Reel, a completely portable unit weighing less than 15 pounds

without cord. It is designed to save time and cord and to speed work on any application requiring extension cords.

The standard unit handles any length of cord up to 400 ft., depending on the diameter of the cord. It is available with or without extension cord.

For additional information, mail a Reader Service card, using the above key number.

Wood and Preuit's New Address

Wood and Preuit's Co., engineers and manufacturer's agents of Philadelphia and Washington, have moved their Washington office from 1740 K Street N.W. to Dupont Circle Bldg. (Room 926), Washington 6, D.C.

WEEDS are OUT at water works installations

DOLGE SS WEED KILLER

can be used to advantage in all areas containing water works installations, where no vegetation whatever is desired. Sprinkled on, in economical dilution, this formula works down to the roots, so that it destroys not only surface growth but the entire vegetable structure . . . particularly important where stand pipe locations must be considered. Keeps the growth down around high reservoirs; with proper application there is no danger that the solution will work into storage facilities.

E.W.T. Selective Weed-Killer

(2-4-D) maintains your landscaping but eliminates noxious weeds. Non-injurious to most grasses, E.W.T. aids in keeping a "well-groomed" appearance to the grounds around your pumping plant, purification plant, storage facilities and administration building.

Both DOLGE WEED KILLER and E.W.T. SELECTIVE WEED KILLER have their place in your ground maintenance program. They forestall hours of expensive labor devoted to weeding by "going to the root" of the weed problem.

Complete literature will be sent on request. If you have an unusual weeding problem, we shall be glad to suggest specific methods for dealing with it.

The C. B. DOLGE CO.
WESTPORT, CONNECTICUT

310

New Oxyacetylene Welding Torch

The Air Reduction Sales Co., 60 E. 42nd St., New York 17, N.Y., has announced the immediate availability of a new oxyacetylene welding torch known as the Airco 800.

Advantages claimed for the new device are that it is suitable for almost any welding job from the thinnest sheet metal up to 1½ in. in thickness. Better flame control, low maintenance costs, and modern design are other advantages.

Use a Reader Service card with the above key number if you desire further information.

Heuser Now Asst. Sales Mgr. Le Roi Co.

The appointment of John E. Heuser as assistant sales manager of the Le Roi Company has been announced recently.

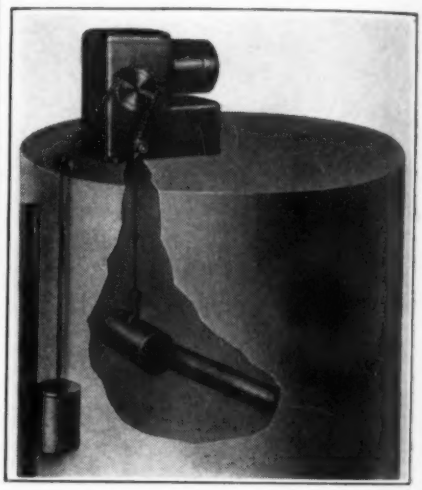
Heuser is a graduate of the University of Wisconsin and prior to coming to Le Roi was district manager for a large bronze foundry.

Mr. Heuser takes over the duties of C. W. Brown, who recently resigned as general sales manager of the company.

311

Chemical Feeding Device

A new liquid chemical feeder with several advances over previous design has been developed by the Liquid Conditioning Corp., 114 E. Price St., Linden, N. J. Known as the Decantrol, this device is a totally-enclosed motor-operated gear reduction unit of special design, mounted on the top of a chemical feed tank.



A feeding sprocket engages with a chain, one end of which is connected to the drawoff head of a decanting pipe. The other end of the chain is connected to a level-position indicator which rises as the decanting pipe is lowered.

This device can be used to feed chemicals either in solution or in suspension (slurry) form.

For additional information mail a Reader Service card marked with the above key number.

312

New Metallizing Gun

According to Metallizing Engineering Co., Inc., Long Island City, N. Y., a new Light-Duty Low Air L Gun uses only ten cu. ft. of air per minute for metallizing. This new gun uses a new turbine construction requiring only one-third the power, making a large compressor unnecessary.

K-1014 New Code Washington Pattern Inverted Key Hydrant Stop and Drain with combined cap and tee. Inside iron pipe threads.

Efficient Operation Longer Service proves Glauber BEST

K-1012 Cap Pattern Hydrant Stop and Drain with loose tee handle, and inside iron pipe threads.

For reliable, trouble-free water line systems, install Glauber ground keys and stops. Glauber quality is proven quality—a result of Glaubers' vast experience in ground key design and manufacture. When laying extensions or new mains, specify Glauber stops and fittings—they'll last the life of any installation.

THE Glauber BRASS MFG. CO., KINSMAN, O.
Division of H. B. SALTER MFG. CO., Marysville, Ohio

Glauber RED BRASS
GROUND-KEY CURB and CORPORATION STOPS
LEAD GOOSENECKS and WATERWORKS FITTINGS

Other features also aid in reducing the weight of the gun and improving its operation.

Further information is available and may be obtained by mailing a Reader Service card marked with the above key number.

S. S. Small Joins A. P. Smith

The A. P. Smith Manufacturing Co. of East Orange, N.J., has announced the appointment of Sid-

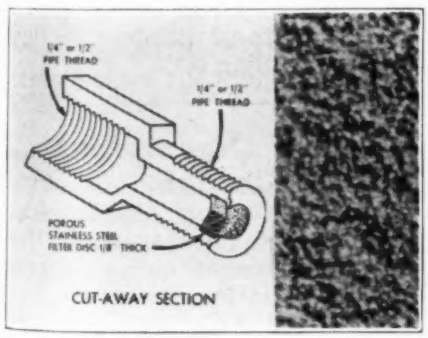
ney S. Small of Los Angeles, as sales engineer in the Arizona and Southern California territory.

Mr. Small is a manufacturers' agent who also represents the Worthington - Gamon Meter Co. He will be associated with Carl F. Noel, an A.P. Smith district sales manager of Oakland, Calif.

313

New Pressure Snubbers

Equipoise Controls, Inc., 100 Stevens Ave., Mt. Vernon, N.Y., has designed a snubber to eliminate pressure gauge fluctuations caused by pressure pulsation and vibration. Featured in this snub-



ber is a porous stainless steel filter disc which provides a relatively large filter surface effectively preventing clog-up in pressure gauge service. These special filter discs are available for air, oil, water, mercury, etc.

Further information is available. Mail a Reader Service card with the above key number.

314

Variable Speed Changer

The Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill., has announced a new H-6 size Link-Belt P.I.V. gear variable speed changer rated at 20 to 25 h.p. The new H-6 unit is rated for speed variation ratios of five to one and six to one at 20 h.p., and for speed ratios of two to one, three to one, and four to one at 25 h.p.

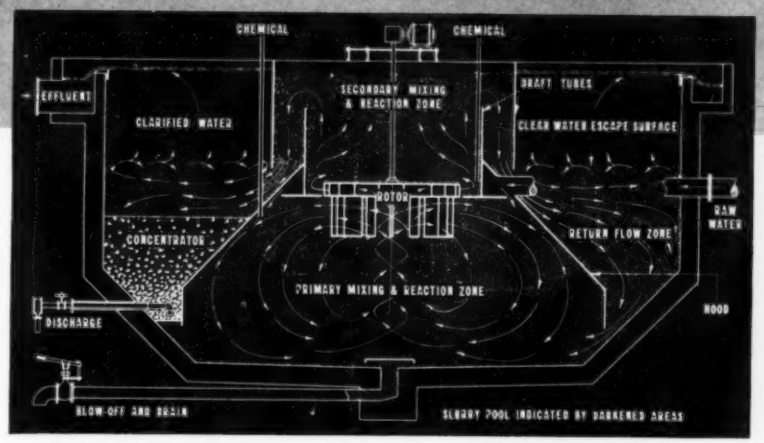
This makes the eighth size in type of speed reducer, ranging from ½ to 25 h.p.

For further information enter the above key number on a Reader Service card and mail.

New Officers of Louis Allis Co.

Due to the expanding operations of the Louis Allis Co., three new offices have been created. Elected to these offices were Louis Allis, Jr., vice president in charge of sales; Frank O. Kovich, vice president in charge of manufacturing, and T. R. Wieseman, vice president in charge of engineering.

YOU GET CONTROLLED SLURRY CONCENTRATION WITH THE ACCELATOR



The ACCELATOR* has a higher concentration of previously formed solids in the primary mixing zone than has any other type of water treating equipment.

Because of this heavy slurry concentration chemical reaction takes place faster and makes it possible for the ACCELATOR to deliver more treated water in less space.

The heavy slurry concentration is controlled by the positive return of solids from the separation zone to the primary mixing zone. This is an exclusive feature of the ACCELATOR.

Ask for ACCELATOR Bulletin 1824. INFILCO Inc., 325 West 25th Place, Chicago 16, Illinois.
*Trade-Mark Reg. U. S. Pat. Off.

ACCELATOR *Advantages*

Highest Rate

Dynamic Separation

Positive Recirculation

Heavy Slurry Concentration in Mixing Zone

Custom-Built Concentrator

Rotor Circulator

IF YOU WANT TO KNOW — ASK INFILCO

315

Hose Menders

"The Best for All Hose Connections" is what the Erco Manufacturing Co., 2368 N. Elston Ave., Chicago 14, Ill., says about its new Grip-Tight hose menders.

This connection for all kinds of hose is easy to apply right on the job. With a special tool and special rust-proof galvanized steel wire, these Grip-Tight hose bands can be applied to any hose from ¼ to 6 inches in diameter.

Further information is available. If you desire it, enter the above key number on a Reader Service card and mail.

Ira T. Collar, Kansas City, Dies

Ira T. Collar, Sr., longtime sales representative for Ford Meter Box Co., Wabash, Ind., Vogt Box Mfg. Co., Louisville, Ky., and Atlas Mineral Products Co., Mertztown, Pa., died recently.

Mr. Collar was well known to the waterworks profession in and around Kansas City.

316

Fire Extinguishing System

American-La France-Foamite Corp. of Elmira, N.Y., has announced a completely new Alfco carbon dioxide fire extinguishing system where localized or total flooding of the area with carbon dioxide is desired.

This system may also be used for rotating electrical units requiring a sustained discharge of carbon dioxide.

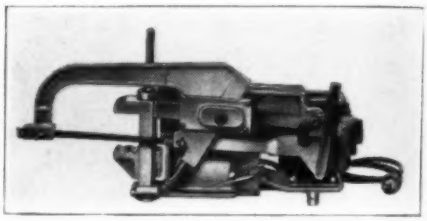
The system as devised will automatically shut off power units, close windows and doors when a fire strikes after sounding an alarm to permit persons to exit from the fire area. Then the system discharges its fire-killing carbon dioxide.

Further information is available. Simply mail a Reader Service card with the above key number.

317

Portable Power Hack Saw

The Lipe-Rollway Corp., Syracuse, N.Y., has developed a new lightweight portable hack sawing



machine called the Hand-I-Hack. It will cut up to 2½ in. iron pipe in any position.

Further information may be obtained by entering the key number above on a Reader Service card and mailing it.

Solvay Organization Changes

Solvay Sales Div., Allied Chemical & Dye Corp., has made the following changes in its branch office organization.

Woodward Allen has been appointed manager at Charlotte, N. C., succeeding the late Harral O. Pierce. M. S. Johnson succeeds Mr. Allen as manager of the Boston office, and H. G. Phillipps, Jr., formerly a salesman in the Cincinnati territory, has been appointed to succeed the late Brice S. Hull as manager of the Pittsburgh branch office. H. W. Causey has been named assistant manager of

BUFFALO METER

Simplicity

COSTS YOU LESS!

● Buffalo Meters have a more simple construction than most water meters, with fewer moving parts. Because of this, these top-quality meters can be sold at moderate price.

Maintenance costs for Buffalo Meters are low. Repair costs are reduced since Buffalo Meters can be taken apart and put together more quickly than can be done with meters of more complicated design. Also, few moving parts means less replacement... ordinarily a considerable item of expense in meter maintenance.

● Buffalo Meter Company makes two brands of water meters... the "American" (bronze casing) for soft or filtered water, and the "Niagara" (galvanized-iron casing) for most hard water requirements. Send for descriptive literature... today!

AMERICAN BRONZE CASE

NIAGARA GALV. IRON CASE

WATER METERS

BUFFALO METER COMPANY

2909 MAIN STREET • BUFFALO 14, NEW YORK

the Charlotte office, and M. F. Kennedy, assistant manager at Pittsburgh.

Additional changes as of the first of the year included H. R. Stoothoff, assistant manager of the Chicago branch, and W. H. Floyd, assistant manager at Cincinnati.

Pennsalt News

The board of directors of the Pennsylvania Salt Mfg. Co. has elected Y. F. Hardcastle, Pennsalt vice-president in charge of manufacturing, as a board member.

Mr. Hardcastle announced the appointment of William F. Mitchell, formerly superintendent of Pennsalt's Wyandotte, Mich., plant, as assistant vice-president.

LITERATURE AND CATALOGS

318

Laboratory Glassware

All water and sewage works and industrial waste laboratories will be interested in the recent publication of the Corning Glass Works, Corning, N. Y. This item, known as **Laboratory Glassware**, carries Catalog No. LP28.

This 180-page catalog, complete with index, is divided into seven parts and presents all types of equipment made from Pyrex, Vycor, and Corning brand alkali resistant wear, as well as the Pyrex brand fritted ware, and the Pyrex brand "Lifetime Red" low actinic ware.

Any piece of glass apparatus you need for your laboratory can be found in this catalog.

If you wish a copy of this catalog, enter the above key number on a Reader Service card and mail.

319

Porcelain Enamel Signs

If you have any place in your plant where you find need of **safety first, warning signs,** or danger signs, perhaps you will be interested in a bulletin issued by the Industrial Products Co., 2820 N. Fourth St., Philadelphia 33, Penna.

This four-page bulletin shows various sizes and shapes of Ipco porcelain enamel signs.

This folder is available. Just mail a Reader Service card with the above key number.

320

Speed Prime Pumps

A complete new line of **Rex "Easy Flow" Speed Prime Pumps** in Bulletin No. 47-12 has been issued by the Chain Belt Co., Milwaukee.

A copy of this bulletin may be obtained by filling in a Reader Service card with the above key number.

321

Abstracts of Water Treatment Articles

Published quarterly as a reference source on the latest technical information on water treatment by the National Aluminate Corp., 6216 W. 66th Place, Chicago 38, Ill., the **Nalco Abstracts** for October, November, and December 1947 are now available.

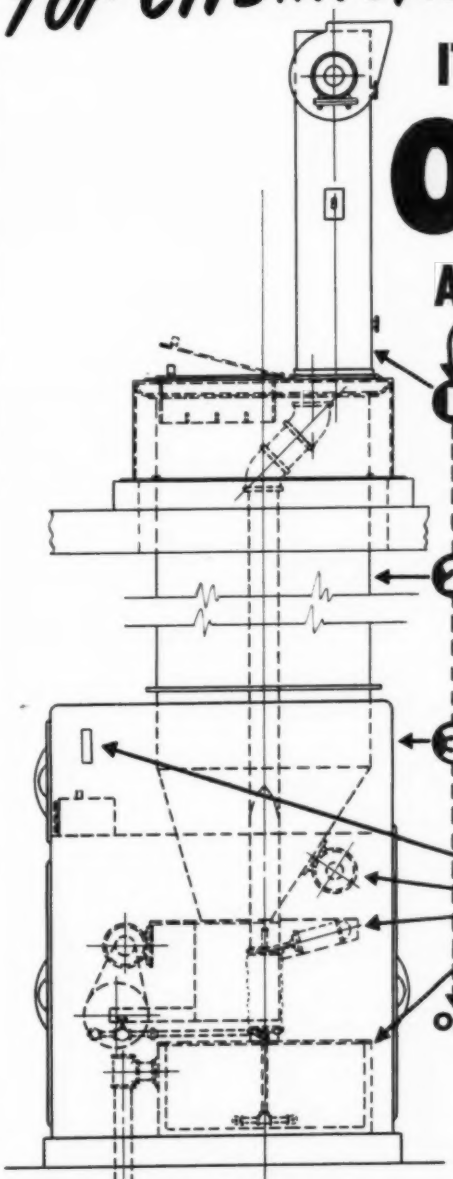
If you are interested in the abstracts of current articles on water treatment with particular reference to power production, enter the above key number on a Reader Service card and mail.

For CHEMICAL FEEDING

IT'S

OMEGA

ALL DOWN THE LINE



1 OMEGA
DUST COLLECTOR
Standard Unit No. 1

2 OMEGA
STEEL EXTENSION HOPPER
(Capacity 50 cubic feet.)
Duct for continuous dust removal

3 OMEGA
LOSS-IN-WEIGHT GRAVIMETRIC FEEDER (Rate of feed 1 to 100 lbs. per hr., lime)

A Scale Beam, capacity 2,000 lbs.
B Hopper Agitator } For hydrated lime,
C Non-Flood Device } soda ash, carbon
D Dissolving Chamber, asphalt-coated, cypress-lined

OMEGA Loss-in-Weight Gravimetric Feeder is invaluable for chemical feeding installations. This most accurate type of feeder, combined with an OMEGA Dust Collector, OMEGA Extension Hopper and Dissolving Chamber, provides a complete unit for lime feeding. Write for bulletin.

OMEGA PRODUCTS
Volumetric Feeders • Gravimetric Feeders • Solution Feeders • Lime Slaking Equipment • Bucket Elevators Laboratory Stirrers

OMEGA MACHINE COMPANY
(Division of Builders Iron Foundry)
10 CODDING ST., PROVIDENCE 1, R. I.

84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

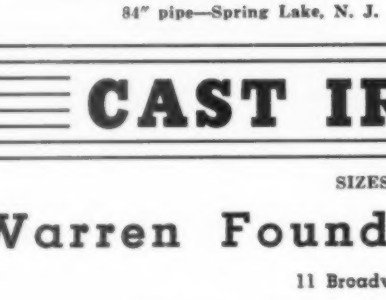
SIZES 2 TO 84

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

FEED-METERS-MIXES
CHLORINE GAS ACCURATELY



PURIFICATION FOR WATER-SEWAGE & SWIMMING POOLS

Everson SterElators Operate Manually or Semi-Automatically, Also Automatically Proportion Gas Flow to Water Flow.

Everson SterElators Utilize a 24" Water Gauge Vacuum and Visible Flow Meters, with Wide Ratio Ranges of Capacities: 10 to 1, 50 to 1, 110 to 1.

All SterElators Are Dependable, Accurate, Safe and Easy to Operate. Guaranteed to Give Complete Satisfaction. NO JOB TOO LARGE

Send us Copy of Specifications

SterElators by Everson

EVERSON MFG. CORP.

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Chicago 10, Ill., U. S. A.

HYDRO-TITE

JUST POUR

THAT'S ALL

Hydro-tite, the self-caulking, self-sealing, pipe-jointing compound, solidifies and hardens immediately without shrinkage. No caulking is necessary. Any slight seepage that may appear at first soon stops.

For over thirty years Hydro-tite has proved its ability to stand up under all conditions of strain, vibration and pressure. Send for data book and sample.

ALWAYS USE FIBREX

The sanitary, bacteria-free packing that costs about 30% less than braided jute. Send for sample.

HYDRAULIC DEVELOPMENT CORPORATION

Main Sales Office: 50 Church St., New York, N.Y.
Works: West Medford Station, Boston, Mass.

322

Inter-floor Transportation

Fast, dependable inter-floor transportation with the Nordyke service elevator has been described in a new bulletin released by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

The elevator is simple in design and of heavy duty construction. It can be used in any building up to 200 feet high. In water and sewage plants it would have an application for transportation of individuals to chemical storage rooms where such exist in towers above feeding equipment.

Bulletin No. 06B6878 is available. Just mail a Reader Service card with the above key number.

323

Vacuum Filter

If you have wondered, as many have, **How the Rotary Vacuum Filter Operates,** then you will be interested to learn that the Filtration Engineers Inc., 858 Summer Ave., Newark 4, N.J., has issued a 4-page pamphlet to explain that question.

A cutaway view with completely illustrated explanation is given. The new bulletin No. 102 is available.

If you desire one of these bulletins, fill in a Reader Service card with the above key number and mail it.

324

Ozone for Water Purification

The Ozone Processes Division of The Welsbach Corp., 1500 Walnut St., Philadelphia 2, Pa., has available Bulletin No. 105 titled **Ozone for Water Purification.**

This bulletin explains why ozone is used to purify water, what ozone is, and how it works to destroy bacteria and taste and odors.

One section of the bulletin is devoted to American practice, another to taste removal, a third to color removal, and a fourth to algae removal.

Also included in the bulletin is information on the effect of ozone on increasing coagulation, how ozone is produced, the ozone generating process, and a description of the ozonizer which produces the ozone.

The bulletin concludes with data on operating costs and information on how to obtain laboratory and field testing.

During the war the development of the ozonization process was retarded, but the ozonators are now again available.

If you desire further information on ozone for water purification, enter the above key number on a Reader Service card and mail.

325

Utility Pump

Four new self-priming portable pumps designed expressly for utility company maintenance work are described in a bulletin recently released by Marlow Pumps, Ridgewood, N.J.

The bulletin, titled **"Facts About a Better Pump for Utility Use,"** contains but four pages but gives information on the sizes of these portable units, as well as the weights and capacities.

This booklet may be obtained by mailing a Reader Service card with the above key number.

326

Neptune News

A recent edition to the list of company house organs which come to our desk is the **Neptune News**, published in Long Island City, N.Y., by the Neptune Meter Company.

A four-page folder, the first edition was issued in January 1948 under the editorship of James L. Wheelin. Written as an inter-office house organ, the *Neptune News* contains sections on Who's Who and Tin-Types, as well as a Hats Off Corner and news of the various offices from coast to coast.

One item of interest to waterworks men everywhere was a note that Rollo K. Blanchard, vice-president of the company, is recuperating from a heart attack and will soon leave for a vacation in Florida.

327

Malleable Fittings

Under the title **Malleable Fittings for Brazed Joints,** Stanley G. Flagg & Co., Inc., 1421 Chestnut St., Philadelphia 2, Pa., has issued an illustrated catalog that should be of considerable interest to engineers and operators in this field.

Known as Flagg Flow Malleable Fittings, the catalog describes the threadless malleable iron pipe fittings for brazing to standard black steel or wrought iron pipe, giving a "one-piece" system as strong as the pipe itself. By eliminating threading the full strength of the pipe is utilized, and the interior design of Flagg-Flow Malleable Fittings tends to reduce turbulence because the internal diameter of the fitting is the same as the internal diameter of the pipe.

These fittings will find use on hot and cold water lines, steam lines, radiant heating, fuel oil piping, meter and instrument lines, boiler feed lines, process piping, air, steam, oil and water systems within the allowable pressure and temperature range.

If you are interested in this new development in piping systems, send for this bulletin by entering the above key number on a Reader Service card and mailing it.

328

Gas Mask Equipment

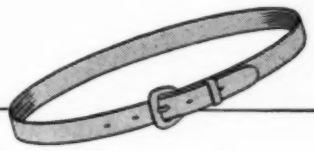
The Acme Protection Equipment Co., 3037 W. Lake St., Chicago 12, Ill., has issued a series of illustrated bulletins showing a wide range of protection equipment for use in hazardous gas and smoke atmospheres.

One of the bulletins features the **Acme Full-Vision** gas masks.

Use the above key number on a Reader Service card if you desire this series of bulletins.

Adjustable

TO THE WAISTLINE



Adjustable

TO THE

PIPE LINE

The Dresser Style 60 Bell-Joint Clamp is adjustable to variations in bell-and-spigot dimensions—makes installation easy and seal completely effective, even on off-size pipe.

High, uniform "pack" all the way around for a *permanently* tight repair on leaking bell-and-spigot joints.

DRESSER **BELL-JOINT CLAMPS**

ONE OF THE DRESSER INDUSTRIES

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pennsylvania.
In Texas: 1121 Rothwell St., Houston. In Canada: 60 Front St., W., Toronto.
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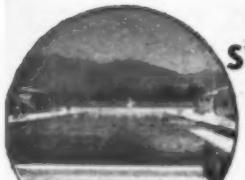
CHEMCO
Equipment
FOR
EVERY CHLORINATION
AND
WATER CONDITIONING
PROBLEM

For Your
SEWAGE PLANT

CHEMCO CHLORINATORS are available for every type of installation. The above shows two CHEMCO 100# capacity chlorinator installed for the State of New York. Note use of Aqua-Thermal Coils.



For Your
SWIMMING
POOL
CHEMCO has "Everything for the Swimming Pool" from the Filters to the Life Preservers.

For Your
WATER WORKS

A large Chemco-Filter Plant installation for the Santa Fe Railroad, Winslow, Arizona. Consult CHEMCO first for your Chlorinator or Water Conditioning Problem.

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Los Angeles 54, Calif.
MIDWEST FACTORY BRANCH
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AGENTS IN PRINCIPAL CITIES

329

Mexican Water Methods

In the Fall 1947 issue of **The Iron Worker,** published by the Lynchburg Foundry Co. of Lynchburg, Va., there is an article on "Modernizing Mexican Water Methods." Written by W. Martin Johnson, Chief Engineer, Wiley & Wilson, the article tells of the difficulties of modernizing water supplies when only primitive construction methods are available. Photographs illustrate the difficulties of construction.

330

Rotameters

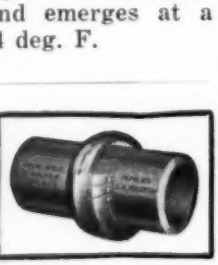
Fischer & Porter Co., Hatboro, Penn., manufacturers of rotameters, has issued Catalog Section 25-E on the **Series 700 Flowrator.** This is a totally enclosed metering instrument so constructed as to prevent damage from the outside. The bulletin illustrates the nine basic advantages of the device and shows the many features of construction. The catalog also shows different size tube lengths for different degrees of accuracy; twin and multiple units; methods of mounting; portable flowrator test kits, and alarm systems. Catalog Section 25-E may be obtained by writing for it.

331

Largest Artesian Well

In the October issue of **Cast Iron Pipe News,** published by the Cast Iron Pipe Research Assn., is an article about the world's largest artesian well. Located at Riverside, Calif., the well, 20 inches in diameter and 1100 feet deep, delivers more than 6½ mgd. Static pressure on the well is 22 psi. The water is relatively soft and emerges at a temperature of 74 deg. F.

WESTON



GASKET AND FORM
The Perfected Method for Making
Sewer Pipe Joints of Cement

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

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LEADITE
The Pioneer Self-Caulking Material for C. I. Pipe

There is no substitute
for LEADITE

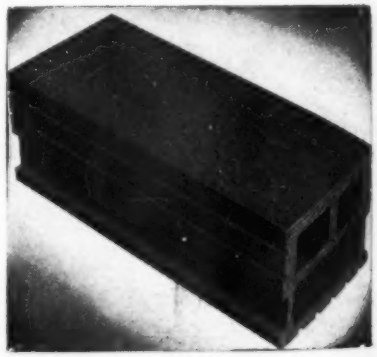
LEADITE is the original melted self-caulking material for jointing c.i. bell & spigot pipe. . . . And, it has been specified and used with great satisfaction by Engineers, Water Works Operators and Contractors for more than 50 years.

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

Leopold

GLAZED FIRE CLAY TILE FILTER



• Permanent • Non-corrosive • Economical • Impervious to acid or alkali solutions • Practically non-absorbent • Equal distribution.

Complete water purification and sewage plant equipment.

Write today for complete information

F. B. LEOPOLD CO., INC.
2413 W. CARSON ST. PITTSBURGH 4, PA.

332

Chlorinators

In Bulletin No. 3000, issued by the Everson Manufacturing Co., **Sterelators by Everson** are shown. The bulletin includes pictures of installations, descriptions of various controls of these chlorinators, and the different sizes and types available.

In addition, the bulletin shows Everson Suction Pool Cleaners, portable self-priming pumps, Everson underwater lights and observation windows, as well as Everson swimming pool accessories and filter service.

Write for Bull. 3000, directly to Everson Manufacturing Co., 214 West Huron Street, Chicago, Ill.

333

Control and Metering Devices

Two catalogs have recently been published by the Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia 44, Penna. The first of these is Catalog 2221 on **Differential Controllers for Flow and Liquid Level.** In this 48-page catalog will be found information on suitable instruments and systems that separately or in combination will answer simple or involved control problems. Schematic diagrams, photographs, and dimensional drawings illustrate the constructional features and principles of operation of no less than ten instruments from differential flow meters to Air-O-Motor Valves and Control Accessories.

The second catalog, No. 8905, contains 40 pages of material on **Air Operated Controllers** for the automatic control of industrial processes. Included in the catalog are complete descriptions of control instruments for temperature, pressure, flow, liquid level, and humidity.

Either or both of these two catalogs may be had by any of our readers who request them.

Bulletin WG1220-5-46 of the De Laval Steam Turbine Co., Trenton 2, N. J., describes **De Laval Worm Gearing.** The bulletin contains all the information one could desire on the advantages of worm gearing, AGMA service classifications, bearing load formulae, quality control and precision manufacturing, and worm thread and gear tooth data for different ratios, etc. A copy of the bulletin may be obtained by anyone interested in worm gearing.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

"GUNITE" SAVES SEWER IN CANADA

The pictures tell the story. A 6-months-old concrete pipe sewer line at Owen Sound, Ontario, was found to be failing under earth load. The tests shown above were made, and convinced the city officials that a reinforced "GUNITE" lining would correct the trouble, and we did the job in 1934. The sewer was 36" and 48" diameters and one-half mile long.

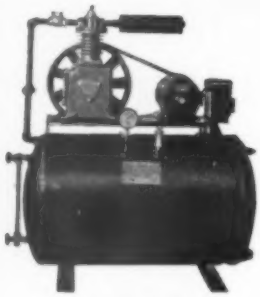
"GUNITE" is ideal for lining and strengthening old brick or concrete sewers and has been widely used for this purpose.

Our 72-page bulletin C2300 describes scores of profitable uses of "GUNITE." Write for your free copy.

PORTABLE GATE OPERATOR

1½ HP. gasoline engine and flexible shaft drive. Variable speed 20 to 80 RPM. Full reverse by lever control. Automatic centrifugal clutch picks up load after engine is started. Revolution counter. Weight of head only 30 lbs. Only one gate key for all gates. A complete power wrench for any power use.

PAYNE DEAN & CO., MADISON, CONN.



No. 2V-APCO

APCO-V-APCO PRIMERS

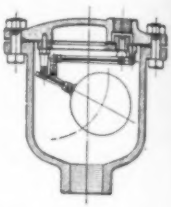
AUTOMATIC POWER OR TANK PRIMERS

AIR RELEASE VALVES

FOR

FILTER PIPE LINES—DISTRIBUTION LINES AND OTHER USES

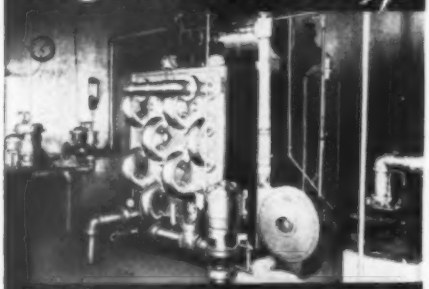
17 TYPES



No. 200 VALVE

VALVE AND PRIMER CORPORATION · 30 W. Washington St., Chicago 2, Ill.

A Better Way of Heating Sludge Digestion Tanks



P.F.T. DIGESTER HEATER AND HEAT EXCHANGER

. . . does away with constantly decreasing heat transfer, greatly reduces the labor of cleaning coils, and minimizes the operating interruptions encountered in the conventional method of heating digestion tanks. Ask for Bulletin 135.

P.F.T. PACIFIC FLUSH TANK CO.
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335

Ear Protector Against Noise

Industrial Products Co., 2820 N. Fourth St., Philadelphia 33, Pa., has issued a folder on **A Simple Solution to the Problem of Industrial Noise.**

This solution consists of a new ear protector named Sepco which can be placed in the ear to absorb the noise in factories. These little devices which mold themselves to the ear canal are carried in a small, compact plastic case. It is also claimed that they aid light sleepers.

Further information is available. Use the above key number on a Reader Service card.

336

Stop That Cold!

As winter wanes and the season of spring colds is upon us, few of us there are who do not realize the tremendous loss to industry from the common cold. As yet perhaps we do not know exactly what causes the cold or exactly how to get rid of it, but there are certain rules for avoiding colds and for treating colds. These have been

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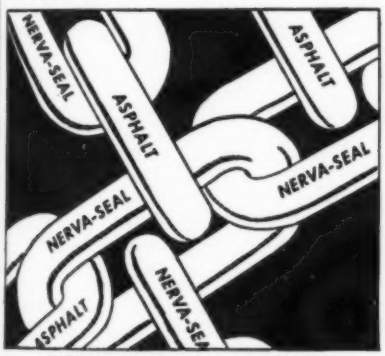

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put together by Dr. Harry J. Johnson in a pamphlet titled **Stop That Cold!** Or "How to avoid and knock out a cold."

Copies of this interesting and helpful bulletin are available. Mail a Reader Service card with the above key number if you are interested.

337

Industrial Waste Abatement

The Manufacturing Chemists' Association of the U.S., 608 Woodward Bldg., Washington 5, D. C., has issued Manual Sheet W-1, titled **Organization and Method for Investigating Wastes in Relation to Water Pollution.**

This bulletin, prepared under the direction of the Committee on Industrial Wastes, chairmaned by Dr. R. W. Hess of Buffalo, is complete in its approach to an organization for effective action and methods for investigating industrial wastes.

Included in the bulletin is information on programs and administration, technical problems involved, engineering design, and plant operation. Under the section of plant operation, such important things are discussed as the selection of a man to supervise the work, collection of basic data, provision of necessary funds, and cooperation with representatives of control agencies.

This bulletin should be in the hands of every industry having a waste pollution problem. It should also be in the hands of every sanitary engineer and sewage treatment plant superintendent who has industrial waste problems.

If you desire a copy of this Manual Sheet W-1, enter the above key number on a Reader Service card and mail.

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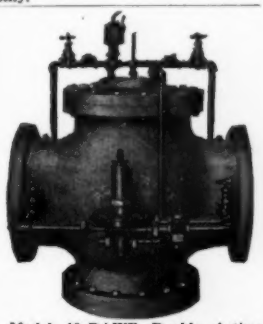
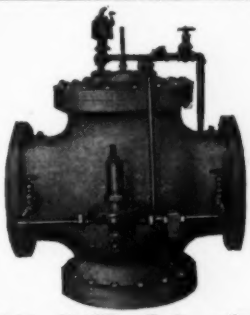


Model 40-DAWR Double Acting may be operated by electric pilot regardless of elevation of water in tank or reservoir, for a break in supply or distribution and when fire pressures require direct pumpage.



Model 30-AWR Single acting valve may be controlled in same manner as the Model 40-DAWR.

Model 40-AWR Single Acting semi-throttling valve will close on reversal of flow and the electric pilot would serve only a single purpose—either to open wide or close as emergency may require.

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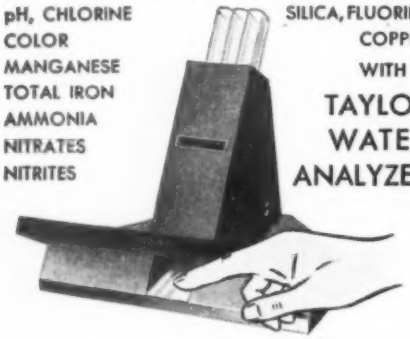

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338

One-Man Loader

A four-page folder, issued by Shoveller Corp., 36 Warren Ave., Portland 5, Maine, shows the use of the **One Man Loader,** a device which can be placed on the back of a truck and made to fill the truck simply by operating the truck backwards and forwards.

One of these devices has been in use for some time at the Portland Water District in Portland, Maine, and it appears quite satisfactory for loading coal, gravel, sand, etc., in trucks as well as for the removal of snow.

The bulletin is available. Just send a Reader Service card with the above key number.

339

Gears, Speed Reducers, Etc.

The Falk Corporation of 3001 W. Canal St., Milwaukee 8, Wis., has released **Bulletin 10,000** which is a condensed catalog of the products, services, and facilities of the corporation.

The bulletin contains descriptions and illustrations of all Falk products, such as gears, speed reducers, Motoreducers, couplings, high speed drives, etc.

The bulletin is available on request. Simply mail a Reader Service card with the above key number.

340

Septic Tank System

Issued by the Small Homes Council, **University of Illinois Bulletin Vol. 44, No. 62,** dated June 16, 1947, carries the circular series Index No. G5.5, and deals with the septic tank systems.

The material in this circular is prepared by E. W. Lehman and contains information on why a

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septic tank should be installed if there is no public sewer, as well as showing the septic tank system and how it works.

This bulletin also gives fundamentals of installation, tank design and size, and how it should be constructed. There is also a section of maintenance of the septic tank and the disposal area required.

A copy of this bulletin is obtainable. Mail a Reader Service Card with the above key number.

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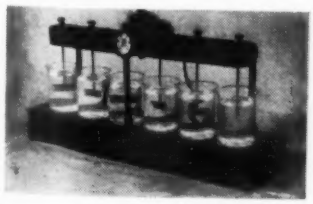

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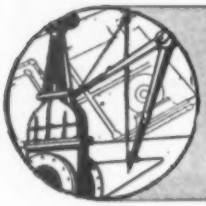

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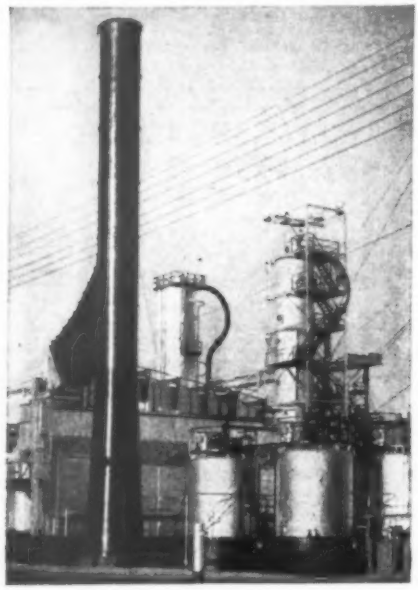

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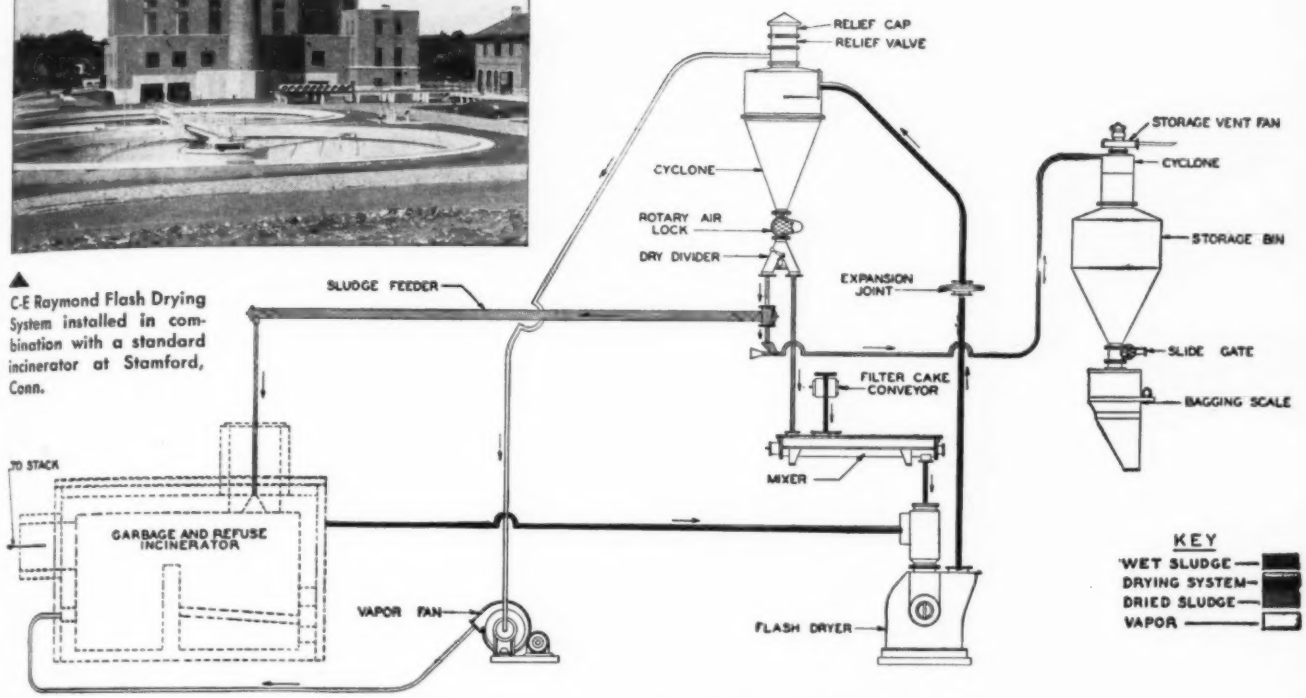

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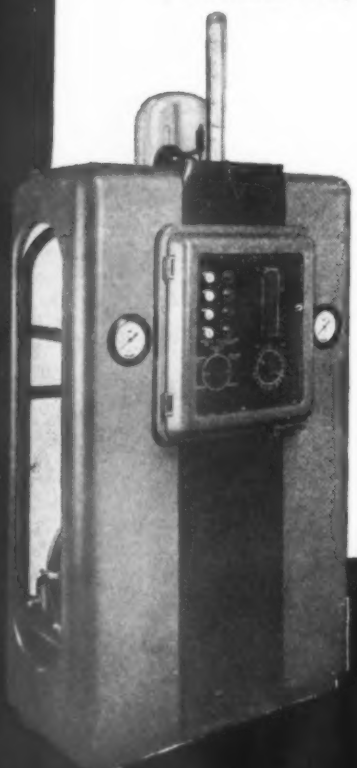

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